NASA Procedural Requirements

NPR 8820.2E
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COMPLIANCE IS MANDATORY

Facility Project Implementation Guide

Responsible Office: Facilities Engineering and Real Property Division

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Preface

P.1 PURPOSE

a. This Facility Project Implementation Guide provides a ready reference to pertinent policy and guidance for management of facility planning, budgeting, design, construction, and activation. This revision incorporates NASA's current management structure and budget cycle. It applies to all construction and renovation projects occurring on NASA-controlled real property. The facility system safety process information was taken from NASA STD 8719.9, Facility System Safety Guidebook. Preproject planning, sustainable design required by Executive Order (EO) 13123, Greening the Government Through Efficient Energy Management, and building commissioning are included in this revision for facility project development and management. The Reliability Centered Building and Equipment Acceptance Guide is incorporated for use in acceptance of facilities construction. The Project Definition Rating Index (PDRI) tool, as developed by the Construction Industry Institute (CII), has also been added. This tool is used to evaluate and measure the level of scope definition of a proposed project.

b. This guide contains paraphrases of the Federal Acquisition Regulation (FAR) and the NASA FAR Supplement for the users' information only. Before relying on the paraphrases for authority, users should consult their contracting officers and the regulations. In the event of conflict between this guide and the FAR or the NASA FAR Supplement, the latter regulations have precedence and users must follow them.

P.2. APPLICABILITY

This NASA Procedures and Requirements (NPR) is applicable to NASA Headquarters, NASA Centers, including Component Facilities, and the Jet Propulsion Laboratory to the extent specified in the contract.

P.3. AUTHORITY

a. 42 U.S.C. 2473 (c)(1), Section 203 (c)(1) of the National Aeronautics and Space Act of 1958, as amended (http://www1.umn.edu/scitech/nasa1958.htm).

b. NPD 8820.2, Design and Construction of Facilities.

P.4. REFERENCES

a. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions.

b. Executive Order 12372, Intergovernmental Review of Federal Programs, 3 CFR (1982 Compilation), as amended by Executive Order 12416, 3 CFR (1983 Compilation).

c. Executive Order 12196, Occupational Safety and Health Programs for Federal Employees, as amended.

d. Executive Order 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Buildings.

e. Executive Order 12941, Seismic Safety of Existing Federally Owned or Leased Buildings.

f. Executive Order 13123, Greening of Government Through Efficient Energy Management.

g. 10 CFR Part 434, Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings.

h. 10 CFR Part 436, Federal Energy Management and Planning Programs.

i. 14 CFR Part 1216, Environmental Quality.

j. NPR 1000.2, NASA Strategic Management Handbook.

k. NPR 1441.1, NASA Records Retention Schedules.

l. NPR 4200.1, NASA Equipment Management Manual.

m. NPR 7120.5, NASA Program and Project Management Processes and Requirements.

n. NPD 7330.1, Approval Authorities for Facility Projects.

o. NPD 8010.2, Use of the Metric System of Measurement in NASA Programs.

p. NPR 8570.1, Energy Efficiency and Water Conservation Technologies and Practices.

q. NPR 8580.1, Procedures and Guidelines for Implementing The National Environmental Policy Act and Executive Order 12114.

r. NPD 8710.5, NASA Safety Policy for Pressure Vessel and Pressurized System.

s. NPR 8715.3, NASA Safety Manual.

t. NPD 8800.14, Policy for Real Property Management.

u. NPR 8800.15, Real Estate Management Program Implementation Manual.

v. NPD 8820.2, Design and Construction of Facilities.

w. NPR 8830.1, Affirmative Procurement Plan for Environmentally Preferable Products.

x. NPR 8831.2, NASA Facilities Maintenance Management.

y. NPD 9050.6, NASA Exchange Activities.

z. NASA Partnering Desk Reference.

aa. NASA Reliability Centered Building and Equipment Acceptance Guide.

bb. NASA Project Definition Rating Index (PDRI) Manual.

cc. Office of Management and Budget (OMB) Circular A-131, Value Engineering.

dd. Office of Management and Budget (OMB) Circular No. A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs.

ee. Federal Acquisition Regulations (FAR).

ff. NASA FAR Supplement (NFS).

gg. NASA-STD 8719.7, Facility System Safety Guidebook.

hh. NASA-STD 8719.9, Safety Standard for Lifting Devices and Equipment.

ii. NASA-STD 8719.11, Safety Standard for Fire Protection.

jj. NSS/WS 1740.10, NASA Safety Standard for Underwater Facility and Non-Open Water Operation.

P.5. CANCELLATION

This revision cancels NPR 8820.2C, dated April 28, 1999. (NPR8820.2D was submitted for coordination then withdrawn and never approved or issued, but the number could not be re-used.)

/s/ Jeffrey E. Sutton
Assistant Administrator for
Management Systems

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CHAPTER 1: An Overview of NASA's Facilities Program

The Vision

The NASA vision is to "improve life here, to extend life to there, and to find life beyond". The mission statement says: NASA will understand the Earth's system and its response to natural and human-induced changes; NASA will enable a safe, secure, efficient and environmentally friendly air transportation system; and NASA will invest in technologies and collaborate with others to improve quality of life and create a secure world. NASA's facilities program supports these vision and mission statements by improving life in the workplace, reducing energy consumption, right sizing our workspace, and maximizing sustainability concepts (reduce, reuse, recycle).

The Legacy

Recognizing the fundamental reliance NASA missions impose upon their supporting facilities, Section 203(c)(3) of the National Aeronautics and Space Act of 1958, as amended, provides the authority for NASA to independently manage its facilities program, or as specifically stated in the Act: "to acquire (by purchase, lease, condemnation, or otherwise), construct, improve, repair, operate, and maintain laboratories, research testing sites and facilities." Relatively few Federal agencies have such broad latitude. The facility engineering professionals who have provided that support since NASA's inception have planned, designed, constructed, operated, maintained, repaired, and restored a physical plant that is unique in the world.

That plant presently includes more than 5,000 facilities with over 42 million square feet and a current replacement value in excess of $20 billion. NASA Centers and Component Facilities occupy more than 100,000 acres of Federal land located at 15 primary sites around the country. Significant facilities are also maintained at several overseas locations. Many of these facilities, such as the massive research wind tunnels constructed in the aftermath of World War II, the rocket development, launch/mission control complexes of the Apollo era, and the redesign from the Apollo expendable rocket to the reusable Space Shuttle are considered to be among the most significant and successful accomplishments in the history of the engineering profession.

The Challenge

NASA's mission today remains as challenging as ever, and both its current and future needs for a large, complex, and reliable physical plant are as great as ever. Missions currently in planning involve such issues as interplanetary human space flight, collection and analysis of extraterrestrial materials, investigations into the origins of the universe, and research leading to the next generation of civilian and military aircraft. They will undoubtedly result in a need for new supporting facilities every bit as significant and demanding as the historical precedents mentioned above.

To meet this continuing challenge, NASA must maintain its independent ability to manage the acquisition, maintenance, and repair of the physical plant with a facility engineering staff capable of performing to the highest possible standards of the profession.

Successful accomplishment of NASA missions requires all of its employees and contractors to constantly work at the cutting edge of their profession. This guidebook provides explicit details regarding the process by which NASA facility professionals must plan, program, design, construct and activate facility projects. Ultimate success of that process, however, relies upon a nurturing environment that provides the following:

a. Recognizes professional achievement and credibility such as professional registration and participation in professional societies,

b. Encourages participation in research activities such as the CII, Federal Facility Council, American Society of Civil Engineers (ASCE), American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), National Fire Protection Association (NFPA), Society of American Military Engineers (SAME) and many others,

c. Is open to new ideas, change, and accepts managed risk, and

d. Exploits opportunity to network and share ideas up, down, and across the Agency, thus, leveraging the extraordinary talents of the individuals involved.

Such an environment has allowed NASA's facilities engineers to successfully adopt and implement forward-thinking facility policies and practices such as Partnering/Teambuilding, Preproject Planning, Value Engineering, Reliability Centered Maintenance, Predictive Testing Procedures, Constructability, Sustainable Building Design, and Performance-Based Contracting. Other similar practice initiatives are currently being studied for adoption. All are fundamental to the successful conduct of facility acquisition management as detailed in the following chapters of this guide.

1.1 Organizational Roles

1.1.1 NASA Headquarters Role. Agency leadership is the major function of NASA Headquarters. In performing this function for the facilities program, Headquarters is responsible for the following:

a. Providing external communication and accountability to the Administration, Congress, and oversight agencies,

b. Integrating the Agency budget,

c. Establishing long-term investment strategy,

d. Establishing NASA policy and standards,

e. Ensuring functional management,

f. Allocating resources,

g. Setting goals across Enterprises, and

h. Providing for central services across the Agency.

1.1.2 Headquarters Facilities Engineering Division Role. The Division provides functional leadership for all Agency facility engineering programs including facility design, construction, maintenance, and real estate. The goal of this leadership is to have reliable facilities available at minimum cost for NASA programs. The Division is pursuing improvements in construction and maintenance to provide the latest state-of-the-art and cost-effective facilities by participating with other Government agencies and external associations. In accomplishing its leadership role, the Division is responsible for the following:

a. Real estate policy, utilization, guidance, and reporting,

b. Facility management systems including:

(1) Specifications-Kept-Intact (SPECSINTACT) - the NASA standard facility construction specification system,

(2) Facility Project Management System (FPMS), and

(3) Automated Real Property reporting systems.

c. Center facilities and real estate master planning policy and guidance,

d. CoF Budget Advocacy, Development, Policy, and Standards, Fiduciary Accountability, Resources, Program Oversight, and Analysis,

e. Facility Project Management policies,

f. Facility Maintenance Policy, Guidance, and Leadership, and

g. Consultant to the NASA Administrator, Chief Financial Officer (CFO), Enterprises, other Headquarters Organizations, and Centers on facilities matters.

1.1.3 Headquarters Enterprises and Institutional Program Offices (IPO) Role. In the facilities program, these offices are

responsible for the following:

a. Formulating program requirements and objectives,

b. Allocating resources for facilities within the context of Agency strategic determinations,

c. Providing Program Office budget guidelines,

d. Determining requirements with Centers, and

e. Determining with Centers candidate projects for inclusion in the proposed budget.

1.1.4 Office of Safety and Mission Assurance Role. This Office is responsible for supporting the Headquarters Facilities Engineering Division in ensuring that a facility system safety program is being implemented at all NASA Centers, Installations, and Component Facilities in accordance with NASA STD 8719.7, Facility System Safety Guidebook. The Headquarters Office of Safety and Mission Assurance shall participate in the review, evaluation, and prioritization of facilities safety projects and corrective actions to ensure that all facility hazards are being eliminated or otherwise appropriately mitigated. Priorities for facilities safety projects and corrective actions will be coordinated with the Enterprise Offices, IPO's, and NASA Centers during the budget process.

1.1.5 NASA Centers. As stated in NASA Policy Directive (NPD) 1000.1C, NASA Strategic Plan, "NASA's Centers are responsible for the safety and occupational health of their workforce and for the safe implementation of the Agency plans, programs, and activities of the Strategic Enterprises." In fulfilling its roles, the Centers are responsible for utilizing, revitalizing, maintaining existing facilities, and developing, planning, budgeting, designing, and constructing new facilities to support the Strategic Enterprises.

1.2 This Guide

NASA's facilities projects vary in cost and complexity. They range from multimillion dollar, state-of-the-art complex facilities to simple facility modifications valued in the thousands of dollars. This document provides NASA program and project managers guidance for managing the budget; requirements definition; project planning and development; project approval processing; and design, construction, and activation of all facility projects regardless of the dollar value or complexity. Appendix H, FPIG Requirements (Must Do), provides a listing of "is/are required" and "must" requirements included in the FPIG. The requirements are presented for quick reference in tabular form providing the page, paragraph number, subject, and copy of the requirement as stated in the FPIG. Users of this quick reference should review the referenced paragraph to ensure that the statement is not taken out of context. In addition, users should review this guide for "shall" statements, which are obligations to act; "should" statements, which implies obligation or preference, but not absolute necessity; and "will" statements, which are predictions of future action. The Facilities Engineering Division's Facility Program Manager may approve variations to the requirements listed in Appendix H with proper justification. Following are overviews of the chapters included in this guide.

1.2.1 Chapter 2 NASA's Facilities Program. This chapter details NASA's facilities program content, development, documentation, approval, and execution. It explains how to develop and process Center facility projects. It describes how NASA Headquarters reviews projects and develops the facilities program for submission to the Office of Management and Budget (OMB). It includes facility project fiscal management and an overview of project implementation with reference to other chapters for details.

1.2.2 Chapter 3 Project Planning/Development. This chapter explains how project requirements are developed. It describes the requirements definition process and the required planning documents, including the functional requirements statement, concept studies, and facilities requirements document. It discusses risk management principles and use of the Project Definition Rating Index system. The chapter explains the purpose and use of Preliminary Engineering Reports (PER) and includes the values of developing a project management plan and for planning the final design.

1.2.3 Chapter 4 Design. This chapter provides details for project design and for project construction and activation planning. It includes design management; Architect-Engineer (A-E) selection; parameters, standards and considerations for inclusion in the design; preadvertisement review of contract documentation; a discussion on the types of contracts to use in implementing the designed project; and the plan and its content for activation of the project after construction.

1.2.4 Chapter 5 Construction. Following facility project design, approval, and funding, the next step is construction. This chapter covers the various aspects of managing the construction of the facility project. It includes contract bid package content; authority requirements for advertising; Contracting Officer roles and responsibilities; discussion of procurement methods, bid evaluation and contract award; preconstruction conference; management and control of the

construction, including changes and cost; O&M considerations; and construction contract completion and acceptance including subsystem and system testing and facility and safety inspections.

1.2.5 Chapter 6 Activation. After construction, the final step is the installation and testing of the equipment and systems that are required for the facility to be activated for its intended use. The details of this facility outfitting and turnover of the completed facility to the user and the O&M organization are covered in this chapter.

1.3 Documentation Retention

Documentation created as a result of this guide will be considered Federal records and must be retained in accordance with NPR 1441.1, NASA Records Retention Schedules. For clarification of these requirements, contact the Center Records Manager.

CHAPTER 2: NASA's Facilities Program

This chapter explains NASA's facilities program including describing the types of projects, the issuing of fiscal year program guidelines, development of the individual projects at the Centers, submittal of the projects to Headquarters for review and approval, and project funding and execution. All of these functions are a part of NASA's facilities program.

2.1 Facility Program Content

The annual facility program is part of the Agency's 5-year budget described in NPG 1000.2, NASA Strategic Management Handbook. The CoF program includes projects and real estate acquisitions to accomplish NASA missions. Funds in other budget line items that meet Authorization Act guidelines may be used for facility projects not included in the CoF budget. Facility projects are for new construction, facility revitalization (repair, restoration, rehabilitation, and modification of existing facilities), and facility work at other than Agency installations. The dollar thresholds for various facilities categories described in the following paragraphs and in Figure 2-1, Facility Project Appropriations Categories, are current, but are subject to change in the NASA Annual Authorization Act.

2.1.1 CoF Projects. The projects in the budget line item are divided into categories of discrete projects, which are facility projects exceeding $1.5 million, and minor projects, which includes minor revitalization and construction projects exceeding $500 thousand but not over $1.5 million. The categories are further divided as follows:

a. Discrete projects include the following:

(1) Program Direct (PD) Projects - Facility projects funded by programs to satisfy specific program requirements,

(2) Institutional Projects - Projects required for construction and facility revitalization (repair, rehabilitation, and modification) of the basic infrastructure (roads, utilities) or institutional (support multiple users and/or activities) facilities, and

(3) Emergency Repair Projects - Emergency repairs may be funded from CoF in accordance with Section 309(b), National Aeronautics and Space Act, as amended, and are defined as discrete work regardless of the cost.

b. Minor revitalization and construction projects include the following:

(1) Repair of facilities to restore them to meet their intended purpose, and

(2) Rehabilitation and modification of facilities to renew and help preserve and enhance the capabilities and usefulness of existing facilities and ensure the safe, economical, and efficient use of the NASA physical plant.

Facility Project Categories Funded with NASA Appropriations ($K)

Facility Project Category	Facility Project Approval Levels and Documentation Requirements $ in K			
	Center Approved Non CoF	Congressional Approved Program Headquarters Project Approval		
		Minor CoF		Discrete CoF (1), (3), (4) & (5)
	$50	$500		$1,500
Minor Construction and Revitalization (Repair, Restoration, Rehabilitation, & Modification) (2) & (3)	Center Approved Form 1509 and if over $75,000 Form 1510 (Copies to Headquarters, Code JX)	Forms 1509 and 1510 Required for Minor Projects		Long Form Writeup and Forms 1509 and 1510 Required for Discrete Projects
Land Acquisition (4)	See NPG 8800.15, *Real Estate Management Program Implementation Manual* for Documentation Required			

(1) Emergency repair may be funded from CoF (Section 309(b), National Aeronautics and Space Act, as amended). Projects so funded are defined as discrete work at any cost.

(2) Facility work (other than acquisition of land) which may be required at locations other than NASA Centers or Component Facilities for the performance of program contracts may be accomplished under conditions specified in the current authorization Act.

(3) Unforeseen major work may be accomplished by use of statutory reprogramming as provided in the current Authorization Act.

(4) Land acquisition at any cost, except when acquired for environmental compliance purposes, is defined as discrete work.

(5) Discrete CoF projects are authorized by line item or by the authority stated in items 1 and 3 above.

Figure 2-1 Facility Project Appropriations Categories

(3) New construction to support specific programs and institutional requirements.

2.1.2 Non-CoF Projects. NASA resources may be used to fund facility projects (not exceeding $500,000) including constructing new facilities and repairing, rehabilitating, or modifying existing facilities. These non-CoF projects include PD facility work, items of a capital nature (other than land acquisition), and facility work at other than Agency installations as specified in the Authorization Act. This category also includes facility projects funded from other than NASA appropriations, and those provided for in accordance with NPD 9050.6, NASA Exchange Activities .

2.2 CoF Program Development

The CoF program is developed through a process involving guidance from OMB and/or the President's budget to Congress, NASA Headquarters and Enterprise guidance, and development of proposed projects by the NASA Centers based on the guidance. Program development includes not only the development of the proposed facility projects but also the management and approval of the projects for inclusion in the Agency's budget submittal. This development process is described in the following paragraphs and depicted in Figure 2-2, CoF Program Management.

2.2.1 Guidelines. Each year NASA's CFO considers: OMB guidance and/or the President's budget to Congress and other policy guidance (including Strategic Plan, Performance Plan, Administration and Congressional direction, applicable policies, and NASA Administrator's direction) to develop and issue a Program Operating Plan (POP) electronic call. This call is sent to the Enterprises (Human Space Flight (HSF) and Science, Aerospace and Technology (SAT)), Institutional Program Offices (IPO) and Functional Offices (FO) for their specific guidelines for inclusion in the POP call to the Centers. These specific guidelines are incorporated in the POP call to the Centers which also includes directions, formats, and due dates for preparing and submitting budget data. POP document content and formats are based on Enterprise/IPO/FO/Agency data requirements and/or needs and OMB-specific guidance.

2.2.2 POP Center Submittal. Centers using the POP guidelines issued by the CFO and their facility condition and requirement evaluations prepare their facility projects for submission in the Center's CoF 5-year plan. The projects are developed in accordance with the POP guidance and Chapter 3, Project Planning/Development. The documentation for the CoF projects, prepared in accordance with POP guidelines and paragraph 2.6, Budget/Approval Documentation, are assembled into the Center's POP 5-year plan submittal. The POP submittal includes the Center's CoF 5-year plan of discrete and minor projects for program-related and other facilities work that are to be funded in the CoF budget (see paragraph 2.2.5, Five-Year Plan, for details) and the Center's Facility Planning and Design (FP&D) funding requirements. Each year as additional information on facility characteristics or requirements on a project is developed

and as guidelines are modified, the project documentation is updated.

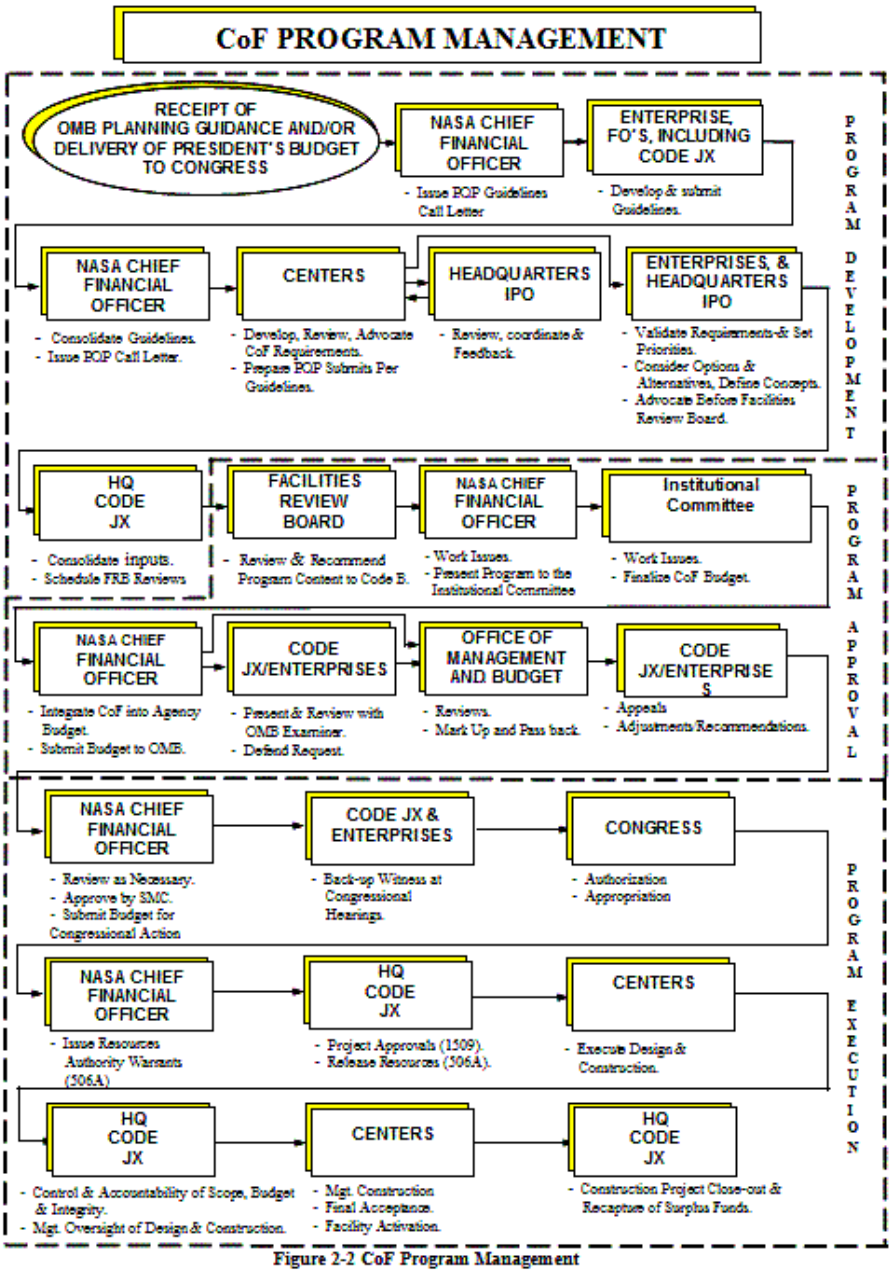


Figure 2-2 CoF Program Management

2.2.3 Fragmentation. In establishing the scope of a facility project, care must be exercised to include all of the needs generated by the same set of circumstances in a single project to avoid fragmentation or even the appearance of fragmentation (see Appendix A, Definitions, for "fragmentation" and "facility project" definitions). Work cannot be fragmented (separated) solely to avoid approval requirements.

2.2.3.1 Establishing Project Scope. Establishing a project's scope depends on the purposes served and the events/circumstances that generated the need for each project. For example, if the lighting system in a building required upgrade throughout the entire building, then this work should be considered as a single facility project. However, if the lighting needs to be improved to a specific level in a given functionally identifiable area (e.g., computer room) and to another level in a functionally different area (e.g., supply service room), then the work could be considered as two separate projects provided the areas are not contiguous.

2.2.3.2 Waiting Period Between Projects. Successive projects within a single facility shall have 90 days separation between beneficial occupancy and the notice to proceed. The reason for this requirement is to avoid the appearance of fragmentation. Headquarters Director, Facilities Engineering Division, must approve exceptions.

2.2.4 Incremental Programming for Facility Requirements. The development of a facility project proposal for the

annual CoF program to satisfy a program requirement includes full disclosure of the scope and cost (see Appendix A, Definitions, Full Disclosure Concept) of the total facility requirements at the specific location. The total facility requirements at the location may include individual facility projects whose scope and need dates are significantly different. These projects should be proposed for different fiscal year submissions and will become the basis for the facility increments to be included over a number of fiscal years. Each increment must be planned to provide a usable facility on a schedule that meets the need date established by the functional requirements.

2.2.4.1 If the planned increment in any one fiscal year does not yield a completely usable facility, the project scope shall be clearly defined for that program year. A limitation of funds clause must be included in the solicitation. (See NASA FAR Supplement, 48 CFR Chapter 18 Part 1852, Subpart 1852.232-77, Limitation of Funds - Fixed-Price Contract.)

2.2.4.2 For proposed CoF projects, which are an increment of a larger total requirement, the individual project justification must highlight this relationship and include the following:

a. A description of the functions to be carried out in the proposed CoF project and how this project is part of the total requirement,

b. An evaluation of mission requirements and engineering and economic factors that are relevant to the incremental plan, and

c. A list of all known future projects that are proposed to meet the total requirement.

2.2.5 Five-Year Plan. A Center's 5-year plan identifies facility project needs that are projected to be required to achieve assigned mission objectives, to provide institutional support, and to revitalize existing facilities. The 5-year plan is updated annually based upon improved information about mission requirements, existing facilities, budget adjustments, advances in R&D, and mission changes. The plan is developed and submitted in accordance with the annual POP guidelines issued by NASA Office of the CFO (see paragraph 2.2.1, Guidelines). An example of a POP 5-year plan submission format is shown in Appendix C Figure C.15, Example - POP 5-Year Plan Submittal.

2.2.5.1 The Center Director, with input from Program Managers, planning, and engineering, shall integrate all program and institutional requirements to be within projected resources (workforce and funding) for each year in the 5-year plan.

2.2.5.2 Format. The 5-year plan format is provided in the annual POP guidelines. The plan includes the budget year (BY) estimate and the four subsequent out years (i.e., BY+1, BY+2, BY+3, and BY+4) as shown in Figure 2-3, CoF 5-Year Plan.

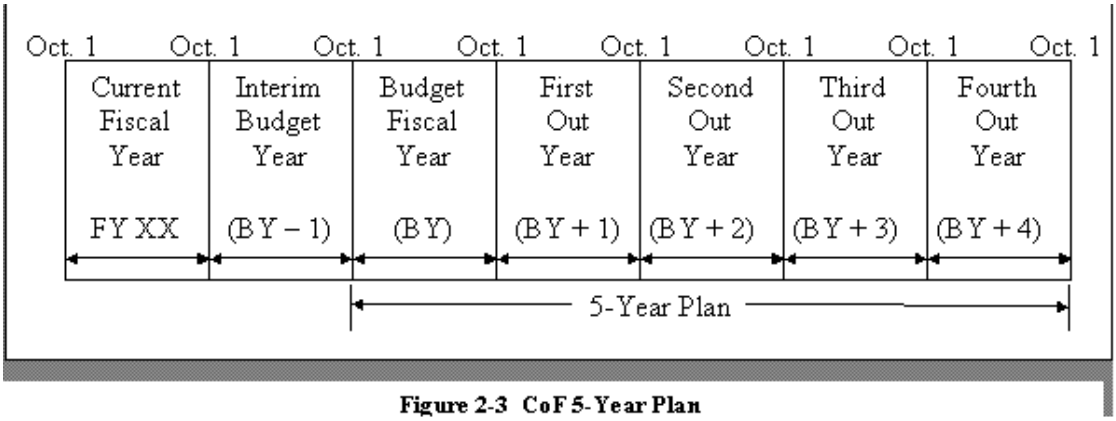


Figure 2-3 CoF 5-Year Plan

2.2.5.3 Scope. The 5-year plan shall include discrete and minor revitalization and construction projects in accordance with the POP guidelines with priorities assigned as specified in the guidelines. Updated NASA Form 1509, Facility Project - Brief Project Document, and NASA Form 1510, Facility Project Cost Estimate, are required for each BY project included in the plan. In addition a long form writeup (see paragraph 2.6.5, Long Form Writeup, and Appendix C, Forms and Instructions) is required for each discrete project in the BY.

2.2.5.4 Headquarters Enterprise and Functional Offices will review the facility projects identified in the 5-year plan and provide guidance and direction to define future facility requirements, including the use of existing facilities; identify facility projects that require additional action; and confirm CoF project advocate responsibilities. This review should include discussions across organizational lines for the purpose of eliminating duplication of facilities or program

requirements either within NASA or the private sector. The Headquarters Director, Facilities Engineering Division, uses the Center submission and results of Headquarters reviews to forecast future CoF budgets and the appropriate levels of facility planning and design effort.

2.2.5.5 Refer to Figure 2-4, CoF Project Cycle, for the schedule for development, submission, and review of the CoF Program including the 5-year plan.

2.3 Public Release

Information regarding facilities projects (including sub-projects and/or work packages) proposed for current or future CoF programs, regardless of the stage of development, must not be disclosed to the general public until released by the appropriate committees of Congress.

2.4 CoF Program Approval

The CoF program approval is described in the following paragraphs and depicted in Figure 2-2, CoF Program Management.

2.4.1 Center's Approval. The Center's POP and facility project documentation are reviewed and approved at the Center in accordance with the POP guidelines and the Center's procedures and then are forwarded to the Headquarters IPO for review and feedback. The Center then makes appropriate updates and submits the POP and CoF documentation to the NASA Headquarters IPO and Enterprises for review and approval.

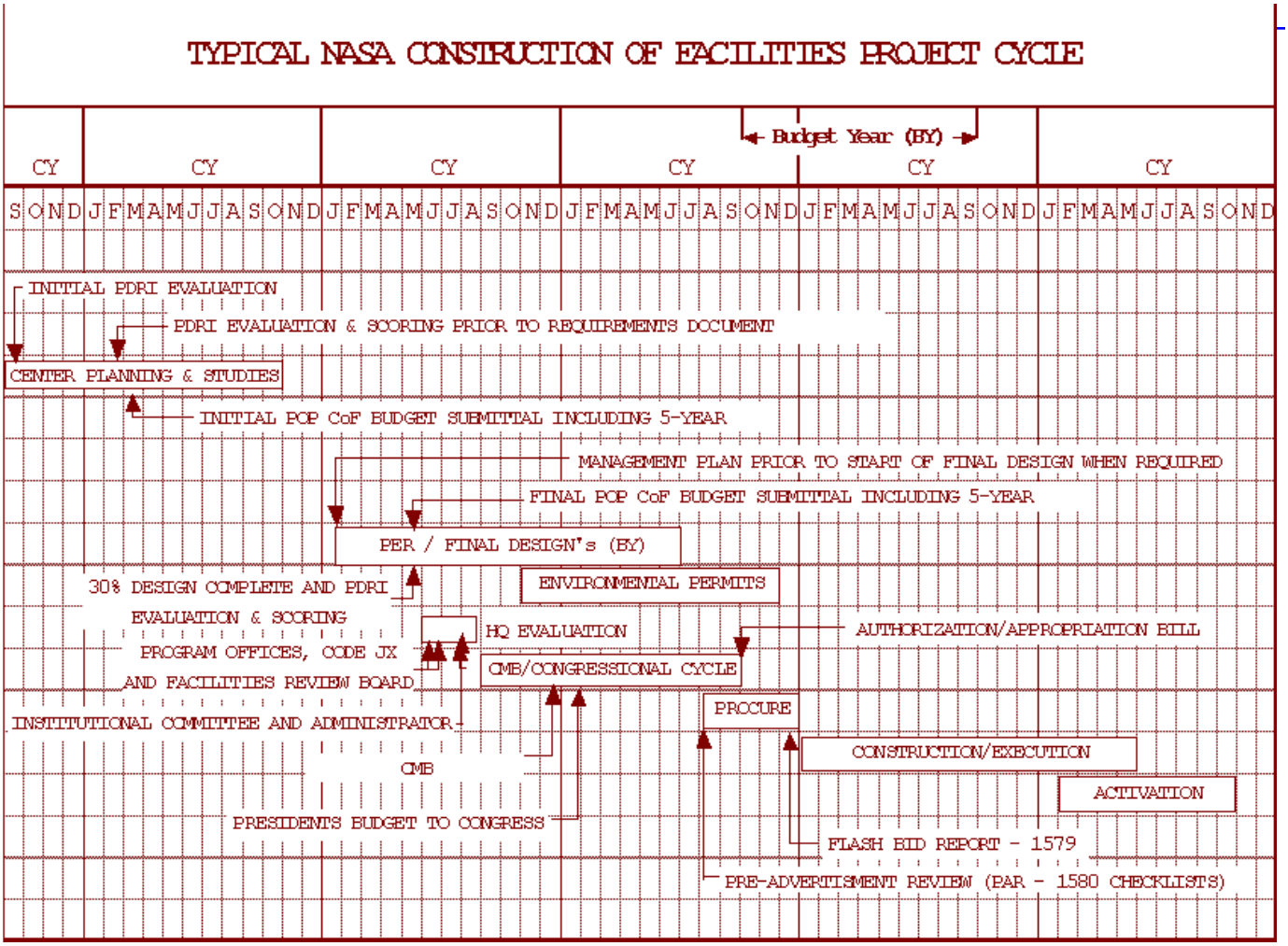
2.4.2 NASA Headquarters Action. Each Program Office, Enterprise, FO, Code JX, CFO, Facilities Review Board, Institutional Committee, and Executive Committee at Headquarters reviews the Center POP submissions. Only those projects supported by this review process and the Administrator are included in the budget proposal to the OMB.

2.4.3 OMB Reviews. OMB reviews NASA's submittal and responds with questions or requests for data. After NASA submits the additional information OMB provides a budget "markup" for use in preparing NASA's final submission.

2.4.4 NASA Final Submission. Utilizing the OMB budget "markup," NASA prepares and submits a final budget to OMB. Following OMB approval, the NASA budget is incorporated into the President's budget for submission to Congress.

2.4.5 Facility Project Authorization and Appropriations. Utilizing the President's budget submission, the Senate and House of Representatives authorize and appropriate CoF projects. Separate committees in both the Senate and House of Representatives develop their own authorization and appropriation bills. The committees may request additional information to support their reviews. The Senate and House of Representatives eventually reach agreement on final authorization and appropriation bills which are sent to the President for approval. After the President signs both bills into law, OMB is able to apportion funds to NASA for the approved discrete projects and the minor program.

2.4.6 Project Oversight. As the CoF program is reviewed and developed, the Headquarters Director, Facilities Engineering Division, and/or the related IPO's, will inform the Centers concerning the status of proposed facility projects. Refer to Figure 2-2, Construction of Facilities Program Management, for CoF program management oversight details.



2.5 Facility Program Execution

It is NASA policy for "Early fiscal year award of all construction projects approved and funded in the year that construction resources are received" (see NPD 8820.2A, Design and Construction of Facilities). To implement this policy, Centers must expeditiously proceed to implement approved projects or chance a project being placed at-risk (see Appendix A, Definitions) and forfeiting its funding. Facility program execution is described in the following paragraphs and is depicted in Figure 2-2, Construction of Facilities Program Management.

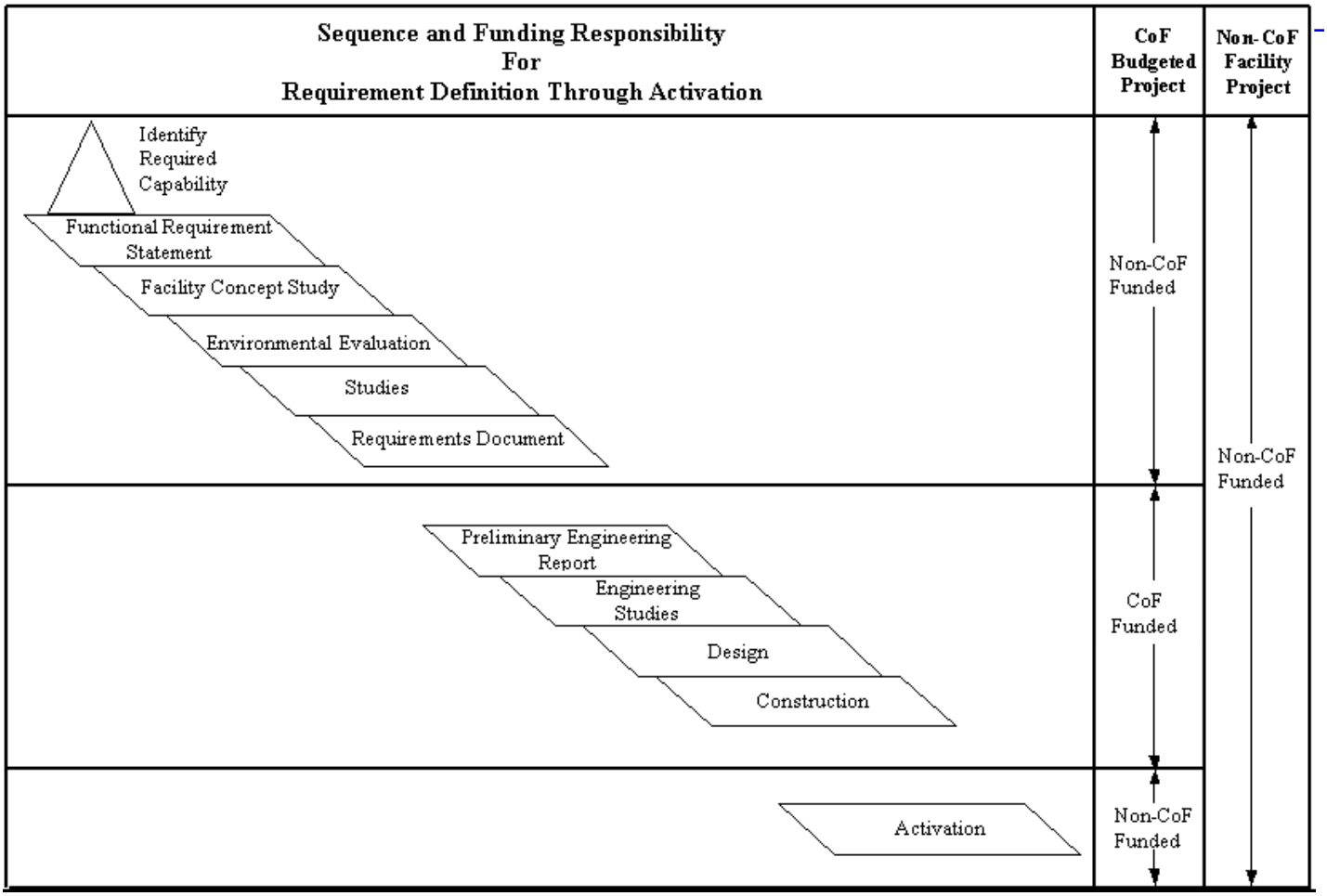
2.5.1 Warranting and Apportioning of Funds. Appropriated funds are made available for expenditure upon issuance by the Treasury Department of an appropriation warrant, which establishes expenditure limits. The OMB exercises further control over the use of these funds by means of its apportionment process. The complete CoF project cycle details are shown in Figure 2-4, CoF Project Cycle.

2.5.2 Financial Resources for Facility Projects. The annual appropriations and authorization Acts are the principal funding authorities for significant facility projects. This funding is for the preliminary engineering, design, and construction of the projects. Identifying, planning, and developing the requirement into a proposed project and its activation after construction are paid for from non-CoF funds (see Figure 2-5, Facilities Project Activities and Funding). Non-CoF funds, within certain statutory and fiscal limitations (see Figure 2-1, Facility Project Appropriations Categories'), can be used for engineering and CoF projects. In some instances, facility work at a Center will be financed by another governmental agency in accordance with Agency agreements, the private sector as specified in contracts, or a nonappropriated fund activity such as a NASA Exchange. Regardless of the source of funds, all facility projects are approved in accordance with the delegation of project approval authority contained in NPD 7330.1F, Approval Authorities for Facility Projects.

2.5.3 Facility Project Fiscal Management.

2.5.3.1 The fiscal funding thresholds for discrete, minor, and routine facility work, as reflected in the definitions in Appendix A and in Figure 2-1, Facility Project Appropriations Categories, are based on the annual authorization and

appropriation legislation; and the National Aeronautics and Space Act of 1958, as amended. Approving authorities, as specified in NPD 7330.1 (for hyperlink see paragraph 2.5.2), Approval Authorities for Facility Projects, are responsible for ensuring conformance with applicable legislated limitations.



2.5.3.2 NASA Form 1509, Facility Project - Brief Project Document, must be approved in accordance with NPD 7330.1 (for hyperlink see paragraph 2.5.2) prior to starting work on any facility project with an estimated cost of $50,000 or more. NASA Form 1510, Facility Project Cost Estimate, is required to accompany the 1509 for each facility project estimated to cost $75,000 or more. The documents should be prepared by the organization requesting approval in accordance with the instructions in paragraph 2.6, Budget/Approval Documentation, and Appendix C, Forms and Instructions. For discrete projects, the facility cost estimate listed on the approved NASA Form 1509 is the maximum that can be expended on the project without further approval. The increase must be approved in accordance with the authority delegated by NPD 7330.1 (for hyperlink see paragraph 2.5.2) before additional obligations may be incurred. Provisions for increases in cost estimates for the minor program are provided on the Minor Facility Projects Summary Brief Project Document, Form 800/01 (see AppendixC) at the time of issue.

2.5.3.3 For all CoF projects, Centers request funds by submitting NASA Forms 1509 and 1510.

2.5.3.4 In addition to the approvals discussed above, the Center must receive a NASA Form 506A, Resources Authority Warrant, from Headquarters Code JX. The warrants grant authority to initiate, commit, obligate, and outlay funds allotted on NASA Form 504 (see paragraph 2.5.3.5). The warrant is based upon requests received from the Center to implement projects (i.e., updated Forms 1509 and 1510 signed by the Center senior facility manager) or to initiate or continue planning for proposed projects. Each release is supported by a project approval document. In addition, for the minor programs, a Minor Facility Projects Summary Brief Project Document, NASA Form 800/01 is issued. This Summary Brief Project Document provides the stipulations for project implementation including cost limitations.

2.5.3.5 The Center must also receive a NASA Form 504 from the NASA CFO/Comptroller providing funds for the Resources Authority Warrant (NASA Form 506A) before any obligations can be incurred.

2.5.4 Facility Project Implementation Philosophy. NASA desires to be a "customer of choice" of the construction

contractor community, and seeks to treat construction contractors fairly and professionally. NASA's construction processes are not static; they are continually improving as NASA seeks out and implements the best practices in the construction industry. NASA emphasizes preproject planning as a means of defining project cost, requirements, and goals and as the "umbrella" process within which a number of other best practices are implemented. These practices include partnering (see NFS, 48 CFR, Chapter 18, Part 1836, Subpart 1836.70), constructability reviews, value engineering, and sustainability that encompasses sustainable design, maintainable design, building commissioning, and facility aspects of safety and security (see Appendix G, Sustainability).

2.5.5 Procurement. Most projects require the services of an Architect Engineer (A-E) firm for the design and a contractor for construction. The following Government procurement regulations are used in acquiring these services:

2.5.5.1 Architect Engineer (A-E) Contracts. NASA utilizes A-E firms to prepare Preliminary Engineering Reports (PER) and designs and to perform engineering studies and other engineering tasks. Contracting for A-E services involves qualification based selection boards and negotiated price arrangements in accordance with Federal Acquisition Regulations (FAR) 36 Subpart 36.6, Architect-Engineer Services) and the NASA FAR Supplement (NFS), 48 CFR Chapter 18 Part 1836, Subpart 1836.6. See paragraph 4.3.3.4, Selection of Architect-Engineers, for selection details.

2.5.5.2 Construction Contracts. Competitive fixed price contracts are preferred for construction work. The Federal Acquisition Regulations (FAR) (48 CFR Chapter 1, Part 36) and the NFS, Part 1836 govern NASA construction contracts. These regulations accommodate a broad range of acquisition and business strategies. Each project's strategy must be carefully planned and coordinated with the Center's procurement office. An example of another approach sometimes used is to award a construction contract to the firm that designed the project (or its subsidiaries or affiliates). This may be used only "if the contract is awarded on the basis of performance specifications for the construction of a facility, and it requires the contractor to furnish construction drawings, specifications, or site adaptation drawings of the facility." See NFS, Part 1836 paragraph 1836.209, for details on this approach.

2.5.6 Project Design.

2.5.6.1 The facility project shall be designed to meet the approved requirements and scope. See Chapter 4, Design for details.

2.5.6.2 The Center Director or designee has approval authority for a project's technical design. Either signature on the drawings indicates approval of the design. The approval certifies that the design meets the functional requirements and scope within the approved budget. In the exercise of this authority, the Director or designee shall ensure that the facility users and safety, health, environmental, maintenance, and energy conservation offices participate in the requirements and project development, and design reviews described in Chapter 3, Project Planning/Development; and Chapter4, Design. Two areas with special requirements are the following:

a. The Code of Federal Regulations (CFR), 14 CFR Part 1216 , requires an environmental analysis for each project and an environmental assessment for each discrete project unless the action is one normally requiring an environmental impact statement or the action is categorically excluded, and

b. The CFR, 10 CFR Part 434, Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings, establishes energy conservation performance standards that are mandatory for design of Federal Buildings.

2.5.7 Construction. This phase of implementing a facility project involves the construction of the designed facility and checkout of the constructed facility to ensure that it meets the requirements of the contract documentation. This activity physically provides the approved facility for activation and operations. The steps in the construction process are as follows:

a. Obtain funds,

b. Contract for construction (see paragraph 2.5.5.2, Construction Contracts),

c. Manage the construction contract assuring the facility is constructed in accordance with the design and constructability principles are utilized, and

d. Checkout and accept the constructed facility for activation.

See Chapter 5, Construction, for details.

2.5.8 Activation. Activation is the process that normally follows facility construction. This phase of the facility acquisition process entails the outfitting, testing, and inspection of the facility and its equipment and systems to ensure the facility performs its intended function. In addition, activation may require O&M training and certification in complex technical projects. Following activation the facility becomes the responsibility of the user and the O&M

organizations. See Chapter 6, Activation, for details.

2.6 Budget/Approval Documentation

2.6.1 Full Disclosure Policy on Projects. The documentation supporting a facility project shall identify and disclose all plans, intentions, and costs for the proposed facility. This shall include a complete description of the function and scope of the facility and the financial resources including costs of related equipment needed to provide an operable facility for the intended purpose (see Appendix A, Definitions, Full Disclosure Concept).

2.6.2 Initial CoF Project Submittal. Although a project may have been listed in a 5-year plan submission for several years the initial submittal of a CoF project to obtain PER and/or design funds normally occurs 2 years before the budget year submittal. NASA Forms 1509, Facility Project Brief Project Document, and 1510, Facility Project Cost Estimate, must be submitted when requesting these funds.

2.6.3 Final CoF Project Submittal. In preparing the POP CoF program documentation for NASA review, approval, and submission for OMB and congressional review the following documents that define the functional requirement and describe the proposed facility project are required as appropriate:

a. For discrete facility projects - a one-page long form writeup and updated NASA Forms 1509, Facility Project - Brief Project Document, and 1510, Facility Project Cost Estimate, Life-Cycle Cost Analysis (LCCA), and

b. For minor facility projects Updated NASA Forms 1509 and 1510.

2.6.4 Documentation Requirements for Resource Realignment Action. Facility needs will surface that are outside the authority of the Center and out of the normal budget cycle. Statutory authority for accomplishing these resource adjustments is contained in the Annual Authorization Act. NASA approval authorities for these resource adjustments are stated in NPD 7330.1 (for hyperlink see paragraph 2.5.2), Approval Authorities for Facility Projects. When the Center Director determines that a resource realignment action is needed the following documentation must be submitted to Headquarters:

a. The following are required for all realignment actions:

(1) Letter from the Center Director requesting authority outlining the purpose and scope including cost of the project, and identifying why the action cannot be resolved locally, and

(2) Other information, which would assist in verifying the need for the project.

b. The following are required for minor program upward cost variations above 25-percent , not to exceed statutory limits; discrete project upward cost variations over authorized amounts; and items of a capital nature at locations other than NASA installations up to $1,500,000:

(1) NASA Form 1509, and

(2) NASA Form 1510.

c. The following are required for items of a capital nature at locations other than NASA installations over $1,500,000, statutory reprogramming, and for emergency repairs:

(1) Long form writeup,

(2) NASA Form 1509, and

(3) NASA Form 1510.

d. See paragraphs 2.6.5, 2.6.6 and 2.6.7 for preparation details on long form writeups and Forms 1509 and 1510, respectively.

2.6.5 Long Form Writeup. The long form writeup must include the most current project requirements, scope, and cost information. After the project is transmitted to Congress, no further revisions to the writeup will be made. NASA Forms 1509 and 1510 shall be used to incorporate subsequent project changes. The long form writeup format and instructions are provided in Appendix C, Forms and Instructions.

2.6.6 NASA Forms 1509 and 1510 The NASA Forms 1509 and 1510 are two intra-agency documents used throughout the facility project implementation process. The information contained on these forms must be updated as changes occur in requirements definition, scope, or cost.

2.6.7 NASA Form 1509.

2.6.7.1 NASA Form 1509 is used for documenting and approving facility projects from inception to completion for all facility projects estimated to cost $50,000 or more regardless of location or source of funding. The 1509 approval authorities are stated in NPD 7330.1 (for hyperlink see paragraph 2.5.2), Approval Authorities for Facility Projects.

2.6.7.2 The NASA Form 1509 must provide a full explanation of the proposed facility project, include an accurate and concise description, scope, and justification of the need, and a full disclosure of required resources (see Appendix A, Definitions, Full Disclosure Concept). Line entries on the form shall be completed in accordance with the instructions in Appendix C, Forms and Instructions. When preparing a 1509 for a discrete project, the project scope, cost, and justification must be consistent with the long form writeup.

2.6.7.3 When approved, the 1509 authorizes and directs implementation of the facility project contingent on funds availability. One copy of each locally approved (routine work) NASA Form 1509 and NASA Form 1510 (when applicable) shall be forwarded to the Headquarters Director, Facilities Engineering Division, not later than 10 working days prior to the start of construction.

2.6.8 NASA Form 1510.

2.6.8.1 NASA Form 1510 must be prepared for all projects with an estimated cost of $75,000 or more and must accompany each NASA Form 1509 submitted to Headquarters.

2.6.8.2 The NASA Form 1510 must be used as a summary page for all cost estimate packages developed for facility projects. This includes cost estimates developed as part of a PER (see paragraph 3.18.3, Section III: Engineering and Budget Estimate); cost estimates developed for projects not requiring a formal PER; and cost estimates at the 30, 60, 90, and 100-percent stages of final design.

2.6.8.3 Costs shown on page 2 of NASA Form 1510 shall be divided into the major elements contained in the cost estimate of the project budgetary submission document (i.e., interest in real estate, site development and utilities outside 5-foot line, buildings/structures within 5-foot line, other collateral equipment, and special features). The subdivision of these major elements shall be composed of work packages that can be utilized for procurement planning and subsequent cost control.

2.6.8.4 Line entries shown on NASA Form 1510 must be completed in accordance with the instructions provided in Appendix C, Forms and Instructions. In addition to the instructions in Appendix C see paragraph 3.20, Current Cost Estimate (CCE), for detail discussion of the CCE.

2.7 Facility Program Forms

A number of different forms and reports are separately described throughout this guide, which in total provide a management overview of the facility program. The various forms utilized in this guide and their instructions are detailed in Appendix C, Forms and Instructions.

2.8 Facility Project Management System

The Facility Project Management System (FPMS) is a comprehensive project management and reporting system for discrete, minor, and routine facility projects. It can be used to provide an analysis of the current status of the project and the work schedule.

2.9 Facilities Functional Performance Metrics

Center management, Facility Project Managers, and project teams are encouraged to develop and use metrics that will contribute to effective management of the Center's CoF program and projects. Each year NASA Headquarters requests Centers and Component Facilities to provide facilities functional performance metrics. These metrics are meant to reduce the amount of data Headquarters request from the field organizations. This request is normally in September with response requested by November. The metrics usually requested and the target percentages are as follows:

a. Metrics for facility projects as applicable are as follows:	

(1) Design of Projects. (Institutional, Program Direct, & Minor)	100-percent
Number of designs complete by Oct. 1 of FY Number of projects authorized for design for FY	
(2) 2nd Quarter Construction Contract Awards	100-percent
Number of projects awarded by Mar. 31 of FY Number of projects approved for construction in FY	
(3) Total Fiscal Year Construction Contract Awards	100-percent
Number of projects awarded by Sept. 30 of FY Number of projects approved for construction in FY	
(4) Total Construction Program Obligations	90-percent
Total CoF/Construction $ obligated in FY Total $ avail. (Prior years carryover & obligation authority in FY)	
(5) Discrete Project Obligations	90-percent
Total CoF/Construction $ obligated for FY (Institutional & PD) Total $ avail. (Prior years carryover & obligation authority in FY)	
(6) Minor Program Obligations	90-percent
Total CoF/Construction $ obligated in FY (Minor Program) Total Minor $ available (Prior years carryover & obligation authority in FY)	
(7) Construction Cost Growth	5-percent
Final contract cost in $ Original contract cost in $ for all budgeted work	
(8) Construction Time Growth	5-percent
Final duration in days Original contract duration in days for all budgeted work	
(9) Lost Time - Construction of Facilities Program Incident/Accident Rates	0-percent
N (Number of injuries, illnesses, or lost work days) x 200,000 EH (Total Number hours worked by all employees during year)	
(10) Contracting Officer Final Decisions	0-percent
Number of Contracting Officer Decisions Number of Projects	
(11) Case Litigated	0-percent
Number of Cases Litigated Number of Projects	
b. The following metrics are applicable to projects using best practices:	
(1) Construction Cost Growth	5-percent
Final contract cost in $ Original contract cost in $ for all budgeted work	

(2) Construction Time Growth	5-percent
Final duration in days Original contract duration in days for all budgeted work	
(3) Contracting Officer Final Decisions	0-percent
Number of Contracting Officer Decisions Number of Projects	
(4) Case Litigated	0-percent
Number of Cases Litigated Number of Projects	

CHAPTER 3: Project Planning/Development

This chapter describes and provides guidance in establishing the requirements for planning/development of a facility project. It includes initial project identification through development of the project for final design.

3.1 Facility Project Manager

3.1.1 A Facility Project Manager (FPM) is an individual who has the most direct responsibility to organize, manage, and direct the multitude of activities and complete the assigned facility project work on schedule with the approved funds. Different individuals may fill this role at different phases of a project. Titles used at the different Centers may also vary for this assigned position (see Appendix A, Definitions). The FPM is responsible for working in concert with the advocate/user, and the preproject planning team (see paragraph 3.4, Preproject Planning) in ensuring: project requirements are defined, documented, and validated; appropriate project concept studies considering alternatives are considered; applicable safety, environmental, energy, and occupational safety and health-related requirements are met; project specifications and cost estimates are properly developed and documented; planning for final design is started; and budget/approval documentation is prepared and submitted in accordance with Chapter 1, NASA's Facilities Program. The FPM, working in concert with the preproject planning team, is responsible for ensuring the Facility Project Management Plan is prepared when required for use in the budget, design, construction, and activation phases (see paragraph 3.22, Facility Project Management Plan).

3.1.2 The assigned FPM leads development of the project through ensuring the completion of the following tasks:

a. Preparing a functional requirement statement working in concert with the advocate/user and the operational and other institutional stakeholders,

b. Preparing and updating (as the development phase progresses) the facility concept study that is described in paragraph 3.6, Facility Concept Study. This should include evaluating the project requirements; the proposed site (see paragraph 3.12, New Site Locations, where new real estate is required.), utilities and infrastructure interfaces and impacts in conjunction with master planning; the project scope; reliability requirements for equipment and systems; and any historical preservation requirements,

c. Making an environmental evaluation (see paragraph 3.13, Environmental Requirements) to meet the requirements of the Code of Federal Regulations (CFR), 14 CFR Part 1216, Environmental Quality, in the early stages of the development to avoid problems later in the project cycle that may impact schedule and/or cost. This includes identifying an environmental categorical exclusion or finding of no significant impact, or when required, preparing the environmental assessment, analysis, and impact statement,

d. Verifying and/or identifying safety requirements (see NPR 8715.3, NASA Safety Manual),

e. Identifying options for reducing the use of energy and meeting the energy conservation performance standards of CFR, 10 CFR Part 434(see paragraph 3.14, Energy Efficiency and Water Conservation Considerations),

f. Identifying O&M requirements (see paragraph 3.5, Operations/Maintenance Staff Involvement) including Reliability Centered Maintenance (RCM), Predictive Testing & Inspection (PT&I), and Computerized Maintenance Management System (CMMS) requirements,

g. Addressing sustainability including sustainable design principles for project siting, design, and construction per Executive Order (EO) 13123, Greening the Government Through Efficient Energy Management, design for maintainability, building commissioning and facility aspects of safety and security during project development (see Appendix G, Sustainability),

h. Assuring the Project Definition Rating Index (PDRI) tool is utilized for assessing the project as appropriate,

i. Preparing the Requirements Document (see paragraph 3.7, Requirements Document) working in conjunction with the

preproject planning team (see paragraph 3.4.1), which is the basis for budget submission and project approval documentation. provides details for PERs, if required, and project design,

j. Preparing the Preliminary Engineering Report (PER) when required (see paragraph 3.18, Preliminary Engineering Reports) and facility project cost analysis,

k. Developing an independent cost validation of the facility project work when appropriate. Cost validation is done for facility projects that are complex in nature or have unique features that require additional analysis to define and establish all of the elements of the project cost,

l. Implementing changes in project scope and project cost when approved by the Program Office and Headquarters Facilities Engineering Division,

m. Developing an acquisition (procurement) plan. This should include consideration of the need for multiple work packages (see paragraph 4.2.1.2),

n. Identifying and coordinating related projects and/or construction plans,

o. Developing the project schedule,

p. Developing the Facility Project Management Plan, when required, working in concert with the preproject planning team,

q. Developing budget/approval documents,

r. Verifying and/or identifying occupational safety and health-related requirements specific to protecting workers occupying the new/renovated facility (see NPD 1800.2B, NASA Occupational Health Program), and

s. Identifying whether there are National Historic Preservation Act (NHPA - 36 CFR 800) requirements associated with this project. If there are, integrating those requirements into the project.

3.2 Risk Management

Risk management is a continuous process used throughout the life of a project. It identifies risks; analyzes their impact and prioritizes them; develops and carries out plans for risk mitigation, acceptance, or other action; tracks risks and the implementation of mitigation plans; supports informed, timely, and effective decisions to control risks and mitigation plans; and ensures that risk information is communicated among all levels of a project's management. This process is detailed in NPR 7120.5B, NASA Program and Project Management Processes and Requirements, section 4.2, Risk Management. Variations to this requirement should be coordinated through the Facilities Engineering Division (FED) and the Office of Safety and Mission Assurance.

3.2.1 Risk management should start with the advocate/user making decisions on the basis of an orderly risk management effort that includes the following elements as appropriate:

a. Financial requirements (e.g. worst case for construction, customer equipment, customer relocation, outfitting),

b. Energy considerations (e.g. operations and maintenance costs),

c. Process and technology capability uncertainties,

d. Qualifications of available designers and contractors,

e. Schedule management (ability to meet schedule requirements and relationship to costs),

f. Constructability level (e.g. multiplicity of phases, subcontract efforts, weather impacts), and

g. Facility System Safety (e.g. quantification and qualification of safety risks from concept to activation in accordance with NPR 8715.3, and NASA STD 8719.7, NASA Facility System Safety Guidebook).

3.2.2 As the project moves through the various stages of development, a risk management process should be used to ensure that risks are identified and managed in accordance with NPR 7120.5.

3.3 Requirement Definition

3.3.1 The first and most important phase of a facility project is the advocate/user requirement definition. This is a

progressive process that begins with a determination that a mission, operation, or a research and development task has facility implications that lead to the conclusion that a facility project is required. Early and effective advocate/user-defined requirements are essential for successfully developing the project. Following the determination that a project is required, a functional requirement statement must be prepared to clearly define and document the requirements. This statement is necessary to provide a basis to develop a realistic scope and budget estimate for a facility project to satisfy the requirements. To accomplish these efforts, a FPM must be assigned to work in concert with the advocate/user and the operational and other institutional stakeholders to establish the facility operating parameters, functional arrangements, and project need date.

3.3.2 Strategic Resource Planning (SRP). Periodically, each existing facility should be examined to determine whether to continue using it or to safely deactivate the facility. This evaluation must be consistent with the Center's Master Plan, Enterprise Strategic Plans, and Center implementation plans. Guidelines and instructions for SRP will be provided in each year's POP.

3.3.3 Defining a Facility Project. The advocate/user requirements must be evaluated to identify proposed facility projects prior to preparation of the requirements statement. The principal objective of the evaluation is the early establishment of a solid functional requirement that can be reviewed to determine when and to what extent new, reallocated, or modified facilities are required to meet a specific need. This evaluation should use the definition for "Facility Project" in Appendix A, Definitions, and the following guidance. For a listing of typical facility cost items to include in a facility project, see Appendix D, Facility and Other Related Costs. The definition states a facility project should accomplish all the work in one facility at the same time to meet all of the needs generated by the same set of events or circumstances. In applying the definition in a large facility where more than one user exists, it is possible that two or more facility projects could be properly developed for implementation at or near the same time without fragmentation. See paragraph 2.2.3 Fragmentation, for a discussion on fragmentation and Appendix A, Definitions, for "fragmentation" definition.

3.3.4 Functional Requirement Statement.

3.3.4.1 Once a facility requirement has been identified, the next step is to document the requirements by preparing a functional requirements statement. In preparing this statement, emphasis must be placed on defining the need and scope of the project to successfully compete for the limited facilities resources. The primary use of the statement is to support the Center's decisionmaking process that leads to the inclusion of a proposed project in the 5-year plan or in the budget year request. The statement will also serve as the basis for the subsequent preparation of the Facility Concept Study and the justification in the budget documentation.

3.3.4.2 The requirements statement must define the capability required and evaluate options to meet the stated need. Essential to this analysis is an understanding and discussion of the work force and funding (Institutional, Science, Aeronautics and Technology-SAT, or Human Space Flight-HSF) implications of the various alternatives. The requirements statement should include a preferred option, with reasons given for its preference.

3.3.4.3 Functional Requirement Statement Content. The statement answers the questions listed below and any others the Center feels appropriate. The answers provide the baseline for preparing the Facility Requirements Document that will satisfy the functional requirements. The requirements statement clarifies the capability requirement details well in advance of the CoF cycle and provides the input for the subsequent Facility Concept Study.

a. What missions, operations, or research and development or institutional tasks require this capability?

b. Which Enterprise sponsors this project, and who is the Headquarters advocate? What is the estimate of the work force and annual operations and maintenance funding associated with the initiative? Who are the primary users/benefactors?

c. What link does this have to Strategic Implementation Plans, business goals, core competency assessments, and master plan?

d. What is the required work? What are the expected benefits of the proposed facility? What are the unique features to meet the functional requirement, including occupational safety and health-related (see NPD 1800.2 (see paragraph 3.1.2.r for hyperlink), NASA Occupational Health Program), safety (Refer to NPR 8715.3, NASA Safety Manual) and environmental issues (Refer to NPR 8580.1, Procedures and Guidelines for Implementing the National Environmental Policy Act and Executive Order 12114)? (These are key elements of the preproject planning process because they can identify cost and schedule implications that might otherwise be overlooked.)

e. Must the capability be in a particular location, and if so why? What is the relationship to existing or proposed facilities?

f. What milestone dictates the need for this capability in the requested fiscal year? What is the impact of delay?

g. If this is an ongoing task, what facilities and other resources are currently being used to meet the requirement? Why is it not possible to continue support of the task in this manner?

h. What nonconstruction alternatives for satisfying this requirement were analyzed? What is the disposition of these alternatives?

i. Will the activities in the proposed facility use materials or processes that are potentially hazardous to personnel or the environment?

j. What organization and which individual(s) will be responsible for clarifying requirements or providing additional details, if required, to support future project development?

3.3.4.4 Statement Format. The requirements statement format will vary from a short statement of the requirement providing answers to the applicable questions in paragraph 3.3.4.3, Functional Requirement Statement Content, and any others the Center may feel are appropriate, for a project of minimal scope to a detailed statement elaborating on the answers to the questions and providing any other pertinent information for a large or complex facility project. The statement should be in a clear logical order and be consistent with the Center's decisionmaking and budget process. The statement should identify the organization(s) and individual(s) that are responsible for providing additional information as required.

3.4 Preproject Planning

Preproject planning is defined as a process of developing sufficient strategic information to address risks and decide to commit resources to maximize the chance for a successful project. NASA has adopted preproject planning as a best practice. The advocate/user must identify requirements for inclusion in the functional requirement statement (see Figure 3-1 Project Development Checklist). Once the requirements are identified, the preproject planning process starts and continues through 35-percent design of the project. The preproject planning phase establishes the project requirement and concept, and provides the basis for project budget and approval. The Construction Industry Institute's Preproject Planning Handbook should be used for additional guidance on preproject planning.

3.4.1 To accomplish preproject planning, a team effort utilizing the concepts in the NASA Partnering Desk Reference should be employed. The team must include all project stakeholders and must include the assigned Facility Project Manager (FPM). The makeup of the team may change as the project progresses through its planning/development phase. The team should consist of members with the needed skills, knowledge and authority required to support the planning/development of the proposed project. The team must review existing facilities that may satisfy the requirements and must define and document the required features and capabilities for the project.

3.4.2 Organizing for Preproject Planning. For projects of minimal scope the preproject planning effort may be informal, but for larger or complex projects the preproject planning should be more formal, rigorous, and well-documented. Partnering among the project stakeholders ensures all requirements are understood and incorporated into the facility's documentation and budget. The following are suggestions for use by the preproject planning team as appropriate:

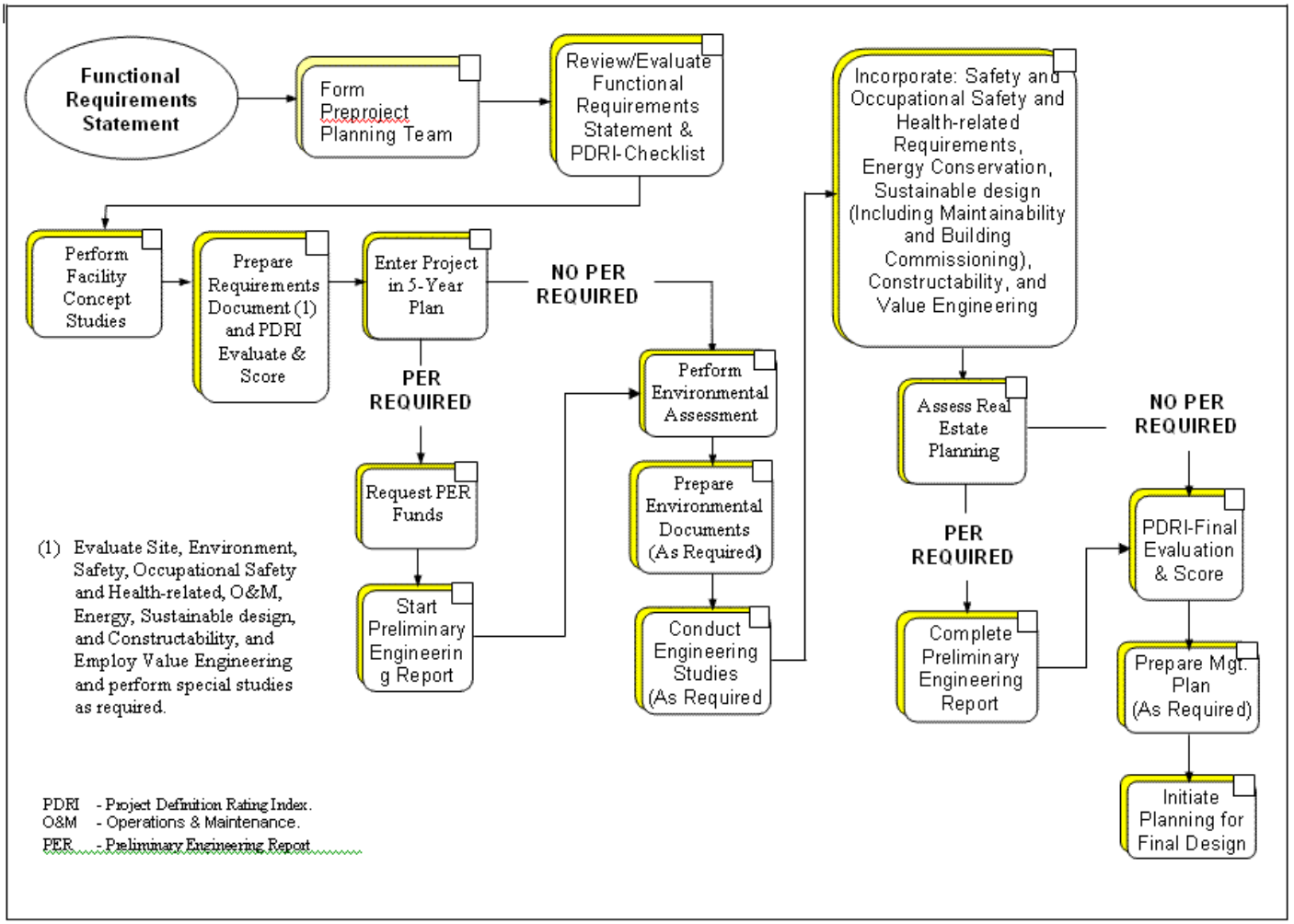
a. Select stakeholders for the team from Center organizations based upon knowledge, skills, authority, and operations and administrative functions that are needed to develop the project requirements,

b. For a formal team, draft a charter to define the objectives. It is important that stakeholders define their respective project goals and understand each other's perspective, and

c. For large or complex projects, develop a Preproject Plan defining needs, requirements, and objectives and team member roles and responsibilities.

3.4.3 After the preproject planning team has been organized for a project, use the Project Definition Rating Index (PDRI) tool (see paragraph 3.8, Project Definition Rating Index) as a check list to collectively review the project so that each team member understands the implications of the project and the team can assess what information is missing so it can be included in the facility concept study.

Figure 3.1 Project Development Checklist



3.5 Operations/Maintenance Staff Involvement

The O&M stakeholder preproject planning team member should identify maintenance support requirements for inclusion in the project development and budget estimates (see NPR 8831.2, NASA Facilities Maintenance Management). Appropriate RCM practices should be incorporated into the project development and design. Elements such as facility access, built-in condition monitoring, data transfer, sensor connections and training should be considered.

3.6 Facility Concept Study

3.6.1 The Facility Concept Study is the process of evaluating concepts for satisfying the functional requirements with the most effective and minimal life-cycle cost solution for the stated functional requirement. The solution must incorporate constructability and value engineering in accordance with NPD 8820.2A, Design and Construction of Facilities, and Office of Management and Budget (OMB) Circular A-131, Value Engineering, (see paragraph 4.4.6, Value Engineering). The Center will normally use local resources (i.e., non-CoF funds and the assigned professional staff) to develop concept studies as appropriate.

3.6.1.1 The Facility Concept Study is a valuable tool for describing the project to Center management and for introducing the project's requirements and benefits to the Enterprise or Institutional Program Office (IPO) advocates at Headquarters.

3.6.1.2 The nature and scope of the project are major considerations in determining the extent of the concept study that will provide the basis for the following:

a. Developing project documents to support a facility proposal for the 5-year facility plan,

b. Identifying any specialized technical features or elements of the functional requirement that require further study and

resolution prior to inclusion in the Requirement Documents (see paragraph 3.7, Requirements Document),

c. Developing a scope of work for preparing a detailed description of the project,

d. Determining the need for an Environmental Impact Statement (EIS) or Environmental Assessments (EA) (Refer to NPR 8580.1, Procedures and Guidelines For Implementing the National Environmental Policy Act and Executive Order 12114),

e. Validating the proposed project's compatibility with the Center's master plan,

f. Validating that the proposed site can support the requirement without impacting other facilities, and

g. Coordinating with the Occupational Health Office to ensure that any necessary engineering controls to reduce/eliminate hazardous exposures are included in the description.

3.6.2 Content of Facility Concept Study. The basic elements of the concept study are an updated discussion of the mission, operations, or research and development tasks that generated the requirement for a new or modified facility. This study generates an expanded description of the proposed facility, with special emphasis on analyzing the relationship between the key facility features and their associated functional requirements. The Facility Concept Study documentation should include the following elements in the format recommended in paragraph 3.6.3, Format of Facility Concept Study:

a. Statement of the requirement - includes a thorough description of the function and operation of the required facility,

b. The functional relationship of the proposed facility to current or new missions or programs,

c. The intended role of the proposed facility for accomplishing the mission or program,

d. Evaluation of options - includes identifying existing facilities (including Government or private facilities) that can be adapted for the new requirement and an explanation if no existing facilities can support the requirement,

e. Rationale and method for determining the project scope,

f. Project description - describes major areas and capabilities that are required for proper operation of the facility including reliability considerations for equipment and systems. The description should include numbers of people, amounts and sizes of equipment, functions to be performed, and special features such as height and weight requirements, support requirements, and any other information that will aid in establishing the project scope,

g. Site description - describes the general characteristics of the proposed project site (see paragraph 3.12, New Site Locations) and should address relationships to and/or impacts upon adjacent activities. Should include a statement that the site has been selected in conformance with the approved master plan (see Appendix F); and that no known environmental limitations exist at the site (Refer to NPR 8580.1, Procedures and Guidelines for Implementing the National Environmental Policy Act and Executive Order 12114, Environmental effects abroad of major Federal actions, and coordinate with environmental office). See paragraph 3.12, New Site Locations, for approval requirements for obtaining new real estate,

h. Structural considerations - describes unusual conditions that should be considered in designing the structure. Requirements for unusual entrances, loading docks, special bay sizes and ceiling heights, or expected vibration requirements should be included to highlight unusual conditions that require special attention. Seismic considerations follow the most current National Earthquake Hazard Reduction Program (NEHRP) standards and EO 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Buildings, or EO 12941, Seismic Safety of Existing Federally Owned or Leased Buildings, as applicable,

i. Mechanical considerations - describes unusual environmental requirements and conditions such as air cleanliness, humidity, Radio Frequency (RF) shielding, and special utility services that will influence the mechanical design,

j. Electrical considerations - describes unusual requirements and conditions that will influence electrical design,

k. Reliability considerations - describes the amount of built-in condition monitoring, data transfer, and sensor connections to be used and maintainability considerations to be included such as access, materials, stanadardization, and quantitative maintenance goals (see Chapter 5 of NASA's Reliability Centered Building and Equipment Acceptance Guide).

l. Fire protection - includes requirements for suppression systems, detectors, and alarms in accordance with NASA STD 8719.11, Safety Standard for Fire Protection,

m. Facility Safety - meets the facility safety requirements of NPR 8715.3, NASA Safety Manual and NASA STD 8719.7, NASA Facility System Safety Guidebook,

n. Life safety - includes requirements from the National Fire Protection Association (NFPA) 101, Occupational Safety and Health Administration (OSHA), and local building codes, especially seismic standards that meet the most current NEHRP standards in all seismic zones as required by EO 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction, and EO 12941, Seismic Safety of Existing Federally Owned or Leased Building,

o. Occupational safety and health-related issues - applies to facility projects and requires compliance with current Federal, State, and local regulations applicable to the operation of the facility.

p. Environmental issues - requires compliance with current Federal, State, and local environmental regulations applicable for the area of proposed construction (refer to NPR 8580.1, Procedures and Guidelines For Implementing the National Environmental Policy Act and Executive Order 12114, and coordinate with the environmental office). (see paragraph 3.13, Environmental Requirements.),

q. Sustainability - Including Sustainable design required to comply with the sustainable design principles of Executive Order (EO) 13123, Greening the Government Through Efficient Energy Management, design for maintainability, building commissioning, and facility aspects of safety and security. (see paragraph 4.4.4, Sustainable Design, for details.),

r. Energy considerations and life-cycle costs - requires careful attention to minimize life-cycle costs per the methodology established by 10 CFR Part 436, Federal Energy Management and Planning Programs, to maximize energy efficiency, to maximize the use of high-efficiency products for building systems, and to meet the design requirements of 10 CFR Part 434, Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings,

s. Public accommodations - includes considerations ensuring that the general public will have safe access to the Center and its facilities, as appropriate,

t. Special considerations - includes provisions for people with mobility and visual impairments and other matters that are important to the proper design of the facility that are not covered in a prior section,

u. Explanation of the project's schedule sensitivity - addresses specifically why the project must be provided in the requested fiscal year. If construction phasing is required over several years, it should be explained,

v. A description of features or components of the proposed facility that may be outside the present state-of the-art in design or construction - includes the arrangements and schedules for accomplishing the research and development work that will provide the information and database for the engineering design of these items,

w. Proposed schedule - shows the POP, budget, PER preparation, design, construction, and activation phases that are consistent with the facility need date,

x. CoF cost estimate - provides cost information developed using the scope and special considerations for the facility project and the current local experience with construction costs. The estimate should be prepared and documented on NASA Form 1510 in accordance with the instructions in Appendix C, Forms and Instructions. The FPM should lead the development of the estimate utilizing preproject planning team members,

y. Related cost estimate - provides a summary list that identifies the costs and source of funds for those elements of the project effort that are not included in the facility project cost estimate. See instructions for preparation of the Related Cost Data portion of the NASA Form 1509 in Appendix C, Forms and Instructions, for estimate details, and

z. Single-line drawings - shows facility location, size, configuration, and functional relationships - depicts unique physical features of the facility.

3.6.3 Format of Facility Concept Study. Much of the material in the Facility Concept Study will be used in the project documents (NASA Forms 1509 and 1510, and the Long Form Writeup) included in the budget submittal. The following format is recommended to facilitate this application:

a. Executive summary - a one-page overview of the key elements of justification, description, cost, and schedule, which becomes Summary of Purpose and Scope,

b. Justification statement - becomes Basis of Need. This statement must clearly present the mission and operational need for the project,

c. Schedule considerations - becomes basis for Impact of Delay,

d. Project description - becomes Scope/Description,

e. Project cost estimate - includes all CoF funded elements,

f. Related costs estimate - includes non-CoF elements and becomes part of other equipment summary,

g. Graphics - includes location and site plans, and elevations, that depict the projects scope, and

h. Appendices - includes equipment lists (existing and planned purchases), staffing information, and other detailed backup data for the basic narrative.

3.6.4 At completion of the Facility Concept Study, the proposed project's tentative scope and budget begin to have exposure at both the Center and Headquarters levels. Since scope and cost are requirements driven and initial impressions tend to be difficult to revise, it is essential that the Facility Concept Study be thoroughly reviewed (see paragraph 3.9, Requirements Reviews) and approved by the project advocates'/users' management.

3.7 Requirements Document

The Requirements Document further defines the details of the project building upon the functional requirements and Facility Concept Study as appropriate. It forms the basis for developing documents for the budget and/or project approval. The document provides facility details required for preparing the PER and/or the design. It is essential that the detailed requirements in this document are accurate and complete for use in further development of the project.

3.7.1 Content of the Requirements Document. The Requirements Document expands upon the Facility Concept Study, emphasizing the detail project description by room/area. This document includes the results of any studies that have been completed and provides detailed criteria (e.g., size, location, environmental) for each of the rooms, activities, or functions included in the facility. The project's PDRI documentation is included in the Requirements Document (see paragraph 3.7.3).

3.7.2 Format of the Requirements Document. The outline established for the Facility Concept Study (see paragraph 3.6, Facility Concept Study) should be maintained with the supplemental descriptive materials referenced to the project description section of the concept study. The FPM can help ensure the completeness of the effort by providing the project advocate/user with a checklist to document the features of each room or functions within the facility. The following elements are included as appropriate:

a. Narrative description of the purpose and/or function of the room/area,

b. Physical dimensions of the room/area including ceiling or hook height,

c. Number and type of personnel assigned to the room/area,

d. Environmental and occupational safety and health-related requirements (e.g., temperature, humidity, ventilation, workstation design, particle counts, radio frequency shielding, noise attenuation),

e. Process power, grounding, and lighting requirements,

f. Uninterruptible Power Supply (UPS) systems and emergency power requirements,

g. Process plumbing requirements,

h. Utility metering and Energy Management Control Systems (EMCS)/Utility Control Systems (UCS) requirements,

i. Fire protection requirements,

j. Communications distribution systems requirements,

k. Special structural requirements (e.g., access, vibration controls, floor loading),

l. Electrical and mechanical systems redundancy requirements,

m. Maintainability and operability requirements,

n. Security requirements,

o. Material handling requirements (e.g., crane or hoist requirements),

p. Listing of major items of process equipment to be installed,

q. Environmental pollution control requirements,

r. Identification of the present location of the activity, if existing, or of an activity similar in nature,

s. Any special studies that influenced the criteria should also be referenced and added in an appendix as appropriate, and

t. The project's PDRI documentation as appropriate.

3.7.3Prior to completion of the Requirements Document and prior to the CoF POP budget submittal a PDRI evaluation and scoring should be made by the preproject planning team in accordance with paragraph 3.8, Project Definition Rating Index (PDRI). This evaluation and scoring is to assess what information may be missing that may affect approval of the project. Following the PDRI evaluation and scoring the document should be revised to include any missing information since budget documentation will be prepared based on the completed Requirements Document.

3.7.4 The completed Requirements Document should be reviewed in accordance with paragraph 3.9, Requirements Reviews, and endorsed by the management of both the FPM and the project advocate/user prior to preparation of budget/approval documents and the initiation of the PER, if required, or design. See Figure 2-4, CoF Project Cycle, to see where the Requirements Document fits in a projects development cycle.

3.8 Project Definition Rating Index (PDRI)

3.8.1 The PDRI is a tool to evaluate and measure the level of scope definition for proposed projects. It is intended to evaluate the completeness of scope definition at any point prior to the time a project is considered for authorization to perform detailed design and construction. Specifically, it is a comprehensive checklist of 64 scope definition elements in a 1000-point scoring system, each element weighted based on relative importance to other elements. The overall rating helps determine whether the project should proceed through the budget cycle, allowing NASA to make the best investments and improving project success by thinking ahead and planning early. For detailed instructions see NASA's PDRI manual.

3.8.2 All Headquarters approved projects must be, and Center approved projects should be, PDRI evaluated at least three separate points during a project's development as explained in the following paragraphs. Scoring of the PDRI will be performed for most projects. Exceptions to PDRI scoring will be documented and explained by the performing organization.

a. After assembling the preproject planning team for a project, collectively use the PDRI as a checklist so that each team member understands the implications of the project, to assess what information may be missing, and to assign actions to collect missing information. Scoring is not recommended at this stage as most of the elements still need to be developed.

b. The facility project should be evaluated and scored by the preproject planning team near completion of the Requirements Document, prior to initial POP budget submittal, to provide a sense of adequacy of the project estimate, rate the completeness of the project scope definition, and to redirect efforts to correct inadequately defined areas prior to design. The PDRI documentation should be included in the Requirements Document.

c. The final PDRI evaluation and scoring is required of all projects and should take place after completion of the balance of the planning documents (planning studies, Requirement Document, Project Management Plan, Economic Analysis, Preliminary Engineering Report) and prior to the "Go/No Go" decision (normally at 30-percent design completion) for final design.

3.9 Requirements Reviews

3.9.1 Reviews of the project development including the PDRI evaluation, either formal or informal, are to be conducted as appropriate at each step of the facility project. This will ensure that the review results are available for the ensuing requirements phase, budget submittal, or for the PER and/or design. The scope and extent of the reviews are scaled to the significance or complexity of the project being reviewed. Formal reviews may be conducted when the project entails large dollar resources, is highly visible, impacts future assignments, or involves matters of substantial concern. A board whose chairperson, membership, and charter are established by a convening authority should accomplish formal reviews (normally, the next decision authority above the FPM).

3.9.2 The objectives of the requirements review is to evaluate how NASA and end-user goals are met, to verify that goals are clearly established and translated into facility requirements; facility requirements are complete; and facility interfaces, constructability, operability, and maintainability are considered and defined. The review process evaluates the completeness of each step in the project development and provides a vehicle for resolving outstanding issues or for obtaining waivers of stated requirements. The review process identifies problems, evaluates approaches, recommends options, and provides information that supports project decisions. Reviews also provide the necessary authority to proceed with the next step in the facility preproject planning process.

3.9.3 At completion of the Concept Study and the Requirements Document a comprehensive requirements review of the project should be accomplished. At these early stages in a project's development, the project direction can be modified without significant cost or schedule impact. This review process is to ensure the project complies with existing internally and externally imposed requirements including safety, security, energy, and environment.

3.9.4 The requirements review agenda should address certain major topics. The depth with which these topics are addressed may vary depending on type, criticality, and cost of the project. The following is a typical list of topics:

a. Trace relationship of the facility requirements to NASA and end-user goals,

b. Operational characteristics, operational requirements, and general constraints,

c. Interface definitions,

d. Performance parameters,

e. Facility configuration and functions within the facility,

f. Life-cycle cost and energy consumption of the facility,

g. Operability and maintainability,

h. Test criteria and methods,

i. Safety, environmental, and occupational safety and health-related considerations,

j. Preliminary cost estimates, trade offs, and alternatives,

k. Schedule and priorities,

l. Problems and areas of concern (i.e., requirements not met or accepted), and

m. PDRI.

3.10 Coordination with the Project Advocate

3.10.1 Facility advocacy at the Center level is normally the responsibility of the facility user who also stipulates the functional requirement for the facility project. At Headquarters, the project advocate is generally the Enterprise or IPO counterpart of the facility user.

3.10.2 At the Center, it is important that the FPM and preproject planning team effectively coordinate with the project advocate/user all matters pertaining to the requirement and justification for the project being proposed. The coordination process entails frequent and effective communication between the facility user, their Headquarters counterpart, preproject planning team, and the FPM. Each of these groups must be kept advised of key elements of the requirements definition process.

3.10.3 At Headquarters, the Enterprise and IPO coordinates with the Headquarters Director, Facilities Engineering Division. The coordination efforts include the following:

a. Reviewing and confirming the requirement as stated by the Center personnel,

b. Defining facility project costs and other related program costs and their impact on overall planning and budget,

c. Confirming project timing in relation to program or mission milestones, and

d. Establishing relative priorities among proposed projects within the same category.

e. Coordinating priorities for facilities safety projects and corrective actions with the Office of Safety and Mission

Assurance.

3.11 Unforeseen Facility Requirements

Regardless of the planning effort, circumstances occur that dictate facility work must be accomplished outside of the normal programming cycle. The following paragraphs provide information on how unforeseen facility projects may be accomplished.

3.11.1 Unforeseen National Program Changes (Statutory Reprogramming). The specific provisions are set forth in the annual authorization Act to provide facilities for unforeseen national program changes. For these facility changes the Administrator will make a determination regarding the need for the facility and will provide written notifications to Congress. A 30-calendar-day wait is required subsequent to notification. Any questions or concerns expressed during this 30-day wait must be resolved prior to initiation of the project.

For documentation requirements for statutory reprogramming see paragraph 2.6.4.

3.11.2 Emergency Repair. The National Aeronautics and Space Act 1958, as amended, provides that any funds appropriated for CoF may be used for emergency repairs if the repairs are deemed by the Administrator to be of greater urgency than the construction of new facilities.

3.12 New Site Locations

To support the NASA mission, facilities are sometimes needed on non-NASA sites. Per NPD 8800.14C, Policy for Real Property Management, Center Directors are responsible for "Securing approval from the Headquarters Director, Facilities Engineering Division, prior to taking real estate actions necessary for mission performance." Center Directors should first exhaust all possibilities for using existing NASA real estate to support the requirement. Where new real property is required, the Center Director should initiate real estate acquisition consistent with the policy and procedures in NPR 8800.15, Real Estate Management Program Implementation Manual.

3.13 Environmental Requirements

For all major federal actions (as defined by 1998 40 CFR 1508.18 - page1, the National Environmental Policy Act (NEPA) requires federal agencies to assess: the environmental impact of the proposed action; any adverse environmental effects which cannot be avoided should the proposal be implemented; alternatives to the proposed action; the relationship between local short-term uses of our environment and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. Preparing the required NEPA compliance studies may take 12 to 24 months for significant projects, and may be a critical path item in project implementation. To avoid delays, the appropriate studies and fair evaluation of reasonable alternatives should begin early and becomes an integral part of the initial project planning. NPR 8580.1, Procedures and Guidelines for Implementing the National Environmental Policy Act, and Executive Order 12114, provide guidance for complying with NEPA regulations on NASA projects.

3.14 Energy Efficiency and Water Conservation Considerations

NASA facilities projects shall incorporate the energy efficiency and water conservation requirements set forth in 10 CFR Part 434, Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings, and NPR 8570.1, Energy Efficiency and Water Conservation Technologies and Practices.

3.15 Safety Requirements

For all facilities projects, implement a Facility System Safety Program to meet the requirements of NPR 8715.3, NASA Safety Manual. A facility system safety analysis is required for changes to existing facility systems whether from in-house developments, facility design/modifications, and Agency operations and activities. The program/project manager, in conjunction with the local safety and mission assurance organization, shall determine minimum mission success criteria, potential for personnel injury, mission failure, equipment loss or facility and/or property damage, the impact to cost and schedule, and the visibility of the program/project to the public. NASA-STD 8719.7, Facility System Safety Guidebook, provides the framework for implementing facility system safety goals and requirements into NASA facilities.

3.16 Life-Cycle Cost Analysis

The life-cycle cost analysis must encompass all program costs associated with a facility including planning, design, construction, energy consumption, maintenance, and salvage or residual value, if any, at the end of the intended period of use. Although some user costs such as noncollateral equipment may not be fully defined, an abbreviated analysis can still provide a valid comparison of options. The life-cycle cost shall include the requirements of 10 CFR Part 434, Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings, which states that the decision-making process for design of buildings shall employ the methodology for estimating and comparing the life-cycle cost of Federal buildings and for determining life-cycle cost effectiveness prescribed in subpart A of 10 CFR Part 436, Federal Energy Management and Planning Programs. In addition NPD 8820.2A, Design and Construction of Facilities, requires an economic analysis on discrete projects in accordance with Office of Management and Budget (OMB) Circular No. A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs.

3.17 Special Studies

The FPM/preproject planning team may require special studies to resolve project scope or cost issues prior to completing the project documentation for the Center's 5-year plan. These studies help identify alternative facility solutions; evaluate and determine the probable facility costs associated with requirements for technology development; and any other unique requirements that could impact facility scope or cost.

3.17.1 A special study is not a substitute for a PER, which is a more in depth analysis/translation of the program functional requirements into facility project design criteria. Special studies should be used to identify, justify, and describe mission, program, institutional, and functional requirements. In general, the study should be developed to the point that it serves as a point of departure for inclusion of the studied requirement in the PER/design.

3.17.2 Study Content. The special study document should include the following as applicable:

a. Statement of requirement that is being tudied,

b. Evaluation of options,

c. Project descriptions,

d. Descriptions of alternative sites,

e. Building systems (i.e., architectural, mechanical, and electrical),

f. Environmental considerations,

g. Public accommodations,

h. Special systems or considerations,

i. New technologies required,

j. Probable construction costs,

k. Related costs/impacts,

l. Schematic drawings/layouts,

m. Proposed schedule showing programming, budget, PER preparation, design, and construction phases that are consistent with programmatic need dates,

n. Functional relationships to current programs, and

o. Value engineering (see paragraph 4.4.6, Value Engineering).

3.18 Preliminary Engineering Reports (PER)

When a PER is required for a project it becomes the link between the planning phase, where the requirements are defined, and the final design. For discrete and complex projects a well developed PER is essential to establish the

project's scope and cost. The PER must include preliminary engineering studies, the analysis of alternatives including the need for multiple work packages (see paragraph 4.2.1.2), definition of essential design requirements and criteria, schematic single-line drawings, siting information and plan, outline specifications, and cost estimates. When a PER is finished it should provide the level of project development necessary to make the decision to proceed with design and construction.

3.18.1 A PER is usually prepared for technically complex discrete projects, and other projects as identified by Headquarters. If a reliable concept and cost estimate exists through the planning phase, then other documentation such as the Requirements Document may suffice in lieu of a PER. For projects where a PER is to be prepared it should be started only after the preproject planning team has determined that the requirements have been fully developed and adequate information is available for engineering development. In requesting PER funds from Headquarters Director, Facilities Engineering Division, the Center must provide a NASA Form 1509 with a project title, brief description, justification and cost estimate, and a NASA Form 1510 with the project's estimated cost.

3.18.2 Policy. The following provide policies associated with preparation of a PER.

3.18.2.1 NASA Form 1509 or other documentation used for obtaining PER funding is the basis for establishing the scope and purpose of the PER. Related documents, such as the Requirements Document, special studies, and Program Office comments, must be considered when formulating the PER. Further development of the facility project (i.e., improved definition of the functional requirement or preparation of the PER) could result in some change in the project physical scope. The scope and purpose set out in the Form 1509 may not be exceeded without the approval of the Headquarters Director, Facilities Engineering Division. Approval is requested and confirmed via the submission of a revised Form 1509.

3.18.2.2 The PER may be accomplished at any time by engineering consultants or A-E firms, a support contractor, Center personnel, or another governmental agency. In those instances where the use of an A-E firm is employed, the cost of the work should generally not exceed 2.0 percent of the estimated cost of construction. The A-E contracting process in paragraph 4.3, Architect-Engineer (A-E) Services, used for contracting for design would be the same process followed to contract for a PER. If the cost of studies, analyses, and/or PER preparation is expected to exceed the upper limit (2 percent), special justification defining the major elements of work and an explanation of the basis of the costs is required by the Headquarters Director, Facilities Engineering Division, prior to the release of facility planning and design funds.

3.18.2.3 The design policies, criteria, and standards contained in this guide shall be used for preparing the PER. Deviations required to meet specific conditions or problems shall be identified in the PER. For selected materials or systems not in general use, a comparative engineering and economic analysis of advantages and disadvantages shall be provided. Safety, energy conservation, environmental concerns (including erosion and pollution control), and sustainability (see Appendix G, Sustainability) including sustainable design, design for maintainability, building commissioning and facility aspects of safety and security shall be considered as prime design factors throughout the preparation of the PER to permit the optimum application of such factors in the possible later design, construction, and operations and maintenance activities. The PER shall meet the requirements of EO 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition.

3.18.2.4 Public Release. The FPM is to ensure that organizations and personnel involved in preparing the PER know that information or work products are not released to the public or other persons without a need to know, and that contracts with A-E's or others contain similar limits. Public release of information in a PER is to be made only by the appropriate Government officials. The PER will not include any classified information. Any necessary classified information shall be submitted separately.

3.19 PER Content

The PER should include the following:

a. Section I: Requirement Statement and Justification,

b. Section II: Descriptive Analysis,

c. Section III: Engineering and Budget Estimate,

d. Section IV: Design and Construction Schedule, and

e. Section V: Appendices to the Report - Drawings.

3.19.1 Section I: Requirement Statement and Justification.

3.19.1.1 This section describes and justifies the project requirements and addresses any specific problems regarding the requirements, and provides a full explanation of the required project completion date. Where possible, Center or Enterprise mission directives should be referenced to support the requirements and required completion date.

3.19.2 Section II: Descriptive Analysis.

3.19.2.1 This section includes a complete and thorough descriptive analysis supplemented, if appropriate, by schematics of the functions and operations to be performed in the facility. The analysis should include the numbers and types of personnel performing each function, the interactions between organizations within the facility, the equipment and utility requirements for each function, and the materials flowing through each function. A life-cycle cost analysis meeting the requirements of paragraph 3.16, Life-Cycle Cost Analysis, shall be provided for the recommended and alternative systems. As appropriate, safety, energy conservation, environmental concerns, value engineering (see paragraph 4.4.6, Value Engineering), and sustainability including sustainable design principles, design for maintainability, building commissioning and facility aspects of safety and security should be considered as prime factors in PER development. The following are basic factors to consider:

a. Architectural design - drawings are single-line schematic plans or diagrams evolving from the facility project or work descriptions. A narrative accompanies the plans describing alternative configurations studied and the reasons for rejection. The gross and net space allocated to individual functions or organizations must be stated. Plans should also reflect the housing capacity, equipment layout, and utility requirements if appropriate. A matrix chart form may be used for utility requirements,

b. Site development schemes - for complex projects, a simplified schematic site plan may be necessary to show all pertinent information such as existing and proposed facility locations, proposed real estate or easement acquisition, site relationship factors, buffer zone, topography, general drainage, vehicular circulation system, and utilities. Normally, this information can be indicated on the site plan drawing (not a schematic) required under Section V (see paragraph 3.19.5),

c. Foundation and structural design - describes and analyzes the recommended foundation scheme and structural system and reasons for their selection and describes other systems considered and reasons for their rejection. A typical schematic foundation and framing plan may be shown if needed for descriptive purposes,

d. Design of structural systems and bracing of other systems (HVAC, piping, electrical, lighting) - describes the recommended systems designed to meet the most current NEHRP standards to comply with EO 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Buildings, and/or EO 12941, Seismic Safety of Existing Federally Owned or Leased Buildings, as applicable,

e. Mechanical design - describes the recommended mechanical system and alternative systems considered. This includes all Heating, Ventilating, and Air-Conditioning (HVAC) systems, and plumbing. The type of HVAC control system to be used and its integration with existing utility control systems, if any, should also be described. Other mechanical systems, depending on the nature of the project, may be described in this section or under the section, Design of Special Systems and Equipment,

f. Electrical design - includes an analysis of the recommended power distribution system including all services and voltages, special power needs such as uninterruptible, emergency or backup power, communication distribution system, lighting system, and other connected loads. A single-line wire diagram is also included,

g. Selection of primary materials and finishes - all proposed materials and finishes for foundations, frames, walls, floors, and roof should be briefly specified in outline specifications,

h. Design of special systems and equipment - many facilities require additional analyses to provide a complete preliminary design. Special systems and life-cycle costs should be analyzed as appropriate,

i. Design for energy conservation - the design method to be employed in achieving compliance with the energy performance standards of 10 CFR Part 434, Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings, should be selected and described. The compliance alternatives are as follows:

(1) Prescriptive/System Performance method,

(2) Building Energy Cost method, and

(3) Building Energy method.

j. Design of fire protection and safety systems - an analysis and design criteria for all proposed fire protection and safety systems are documented in this section,

k. Utilities Capability - Confirmation that the utilities capacity exist to handle the project (sewage plant, water supply, power, roads, and parking) or increased capability is included in the project,

l. Inclusion of facility operations and maintenance considerations - the operability and maintainability of a proposed facilities project must be as great of a concern as constructability. Operations and maintenance considerations should be incorporated in the PER for later inclusion in the follow on design, and

m. Identification of any real estate actions required to support the project must be included.

3.19.3 Section III: Engineering and Budget Estimate. The PER cost estimates will be prepared on NASA Form 1510, Facility Project Cost Estimate, in accordance with instructions in Appendix C, Forms and Instructions. The cost estimating process includes engineering estimates and budget estimates.

3.19.3.1 Engineering Estimate (EE). The estimate shall be prepared in accordance with the following:

a. The EE represents the costs developed from the drawings and draft specifications prepared for the PER. The estimate includes the costs for materials, labor, and services coupled with contractor overhead and profit, based on cost experience at a specific given point in time. Adequate design contingencies should be included for the appropriate stage of project planning/development,

b. The EE must cover all labor and material costs for all items including building type collateral equipment that would usually be furnished by a contractor and installed as permanent in the facility (see Appendix D, Facility and Other Related Costs, for a listing of items and types to include). Installation of Government Furnished Property (GFP) will also be included in the cost estimate. All other collateral equipment will be listed or grouped and the costs made part of the facility project or work package. Estimates should consider current prices in the prevailing market at the site. Not included are amounts for escalation, construction contingencies, and Supervision, Inspection, and Engineering Services (SIES). The estimate should indicate the basis used for the computations. Estimates should identify the fiscal years in which funds are required, and

c. Units of measure, quantities, and unit cost data should be shown for each significant item that can be reasonably identified and quantified. Use of Lump Sum (LS) should be avoided as much as possible if meaningful quantities and unit costs can be applied. The cost estimate will include the following sections as applicable:

(1) Interest in real estate - if the project includes proposed land acquisition or other interests in real estate land and easement costs must be identified,

(2) Site development/utilities - costs normally associated with developing the site such as site clearance and demolition, earthwork, landscaping, storm and sanitary sewage, mechanical and electrical utilities, roads, bridges, marine facilities, and airfield pavements should be included. Elements of this work should be identified as separate procurement entities if such packaging impacts acquisition planning and project control, and

(3) Building/structure (within 5-foot line) - the following categories of construction costs are to be included (in as many entities as reasonable):

(i) Architectural/structural costs normally associated with foundations, structural framing, floors, walls, roofing, finishes, and specialties,

(ii) Mechanical - costs normally associated with mechanical building systems equipment such as HVAC and plumbing. Also includes built-in and large substantially affixed (collateral equipment) mechanical equipment,

(iii) Electrical - costs normally associated with electrical building equipment such as transformers, motor starters and control centers, lighting systems, and communications distribution systems. Also includes built-in and large substantially affixed (collateral equipment) electrical equipment, and

(iv) Fire protection/safety - costs normally associated with fire protection/safety equipment, systems such as sprinklers, alarms, and detectors.

(4) All other collateral equipment - costs for collateral equipment, other than building-type equipment, that will be built-in, affixed to, or installed in real property in such a manner that the installation cost including special foundations or unique utility services, or facility restoration work required after removal will exceed $100,000,

(5) Special features (significant special items) - include costs for plant (process systems, fueling systems, cryogenics)

and personnel protection (fallout shelters, flood control, and medical facilities); environmental concerns (air, water, noise, and special sewage treatment); and, any secondary functions of the project necessary to meet community needs or interfaces with other agencies or organizations, and

(6) Total - the sum of the estimated cost in each subcategory, each category, and the total EE should be shown.

3.19.3.2 Related (Non EE) Cost - all project cost items are not included in the engineering estimate. See Appendix D, Facility and Other Related Costs, for specific items not typically included. Any related cost items that are not covered in the engineering estimate should be explained.

3.19.3.3 Budget estimate - the total budget estimate is a Current Cost Estimate (CCE) that may be developed by NASA personnel and/or by an A-E firm. It is developed in accordance with paragraph 3.20, Current Cost Estimate, and included in each PER.

3.19.3.4 Use of bidding experience - reviewing authorities should analyze current experience on construction work and develop unit costs and cost factors that are used during their evaluation of proposed facility projects. Where cost estimates for the proposed project are considered unreasonably high or low for the type of facility proposed, an explanation should be furnished. This applies to individual items as well as the estimate for the project or work as a whole. Information obtained from earlier bidding/construction experience may be useful as background material in evaluating a project cost estimate. In some submittals of bids, there may occur a close grouping of bids and one or more exceptionally high/low bid(s), which are either non-responsive or gratuitous bids. In using this bid experience to help develop budget estimates for comparable facility work, care should be taken to do the following:

a. Relate the bid spread in such a manner as to provide a reasonable engineering estimate base point of departure, and

b. Reflect potential adverse market changes reasonably. In each case, the base point should be the average of the responsive bids received. Exceptionally high or low bids separated from the main body of competition should be excluded. Contract change order costs should then be added to this base point figure. A reasonable percentage for contingencies should be applied but should be based on the lower risks and fewer unknown residuals in a design of something already built or being built. Escalation should then be applied from the midpoint of the job whose bids are being used to the midpoint of the project being estimated. This approach cannot fully account for, or be responsive to, future conditions that might dilute competition or otherwise generate exceptionally high costs. These factors would have to be incorporated and should be documented.

3.19.4 Section IV: Design and Construction Schedule. Provide a project schedule using a commercially available project planning software and identify the software in the PER. The schedule should include the estimated number of months required for each of the following: preparing the final design plans and specifications; construction acquisition; construction; and facility activation. If more than one construction contract is contemplated, an estimate of the time required for each major contract and the phasing shall be given. If a predetermined need date has been established for the facility, it should be shown in the schedule. The schedule should also comment on time required for separate A-E services, preparation of as-built drawings, long-lead procurement items, special approvals, or other special requirements.

3.19.5 Section V: Appendices to the Report - Drawings.

3.19.5.1 A project location plan, project site plan, and single line plans and elevations suitable for inclusion in the budget submission will be included.

3.19.5.2 During the preparation of the PER, particular attention must be paid to required safety distances, effective land use, topography, accessibility, and energy cost trends. Any proposed land requirements, including easements, should be indicated on the project site plan.

3.19.5.3 Drawings in a PER must stay within the 8-1/2" x 11" format. Foldout drawings may be used if the vertical dimension is held to 11 inches. All drawings must be clear and drawn to scale with a graphic scale and north arrow indicated.

3.19.5.4 The number and type of drawings to be included in the PER depends on the complexity of the facility. The number of floor plans or other drawings on one sheet will also depend on the size and scale that will result in a clear presentation. The following is an example of the drawings to be provided on a single-story building with connecting utilities:

a. A dimensioned site plan indicating the total land area involved, general topography, and extent of paving, landscaping, fencing, and utilities.

b. An architectural floor plan (not a single line sketch) adequately dimensioned and noted,

c. Critical structural drawings including typical foundation and framing plans adequately detailed and noted,

d. Elevations and sections adequately dimensioned and noted,

e. Engineering drawings delineating the nature and integration of all proposed mechanical, electrical, and communication distribution systems with the architectural design, and

f. Any additional drawings, sketches, calculations, design data, and materials used to develop the cost estimate need not be appended to the PER but should be retained for backup support of the estimate.

3.19.6 Real Estate Interest. Real estate easement acquisition data for every project must be analyzed to determine if NASA has sufficient control of the requested real estate. If no new real estate interest is required, a specific notation to this effect should always be included in Section III of the PER. If a project involves real estate or easement acquisition, it must be specifically covered in Sections II and III of the PER. This is required for all items where any real estate interests are involved including acquisition of easements for rights-of-way. For those projects requiring additional real estate (on or offsite) or easements, an appendix will be included in the PER containing, as appropriate, the following items:

a. A tabulation segregated by type of ownership (i.e., private, state, or public domain), of only the acreage proposed for acquisition plus easements for access and utilities. The tabulation should include the assessed value of land, assessed value of improvements, current appraised value, and the number of owners involved,

b. The extent of any street and/or road closings and the extent of any road and/or utility relocations, including a cost estimate for such closings and/or relocation, separate from the land values indicated above,

c. The extent and estimated costs of required additional rights such as mineral rights, timber rights, and easement rights whether outstanding in parties other than the present owners or not; and, a statement as to whether title should be taken in fee simple absolute or subject to such rights,

d. Ancillary investigations - the requirements for soils and hydraulic surveys are to determine the soil, water, and geologic conditions that may affect the following:

(1) Foundation and retaining wall design,

(2) Runoff and seepage of waters into acilities,

(3) Erosion, sloughing, and sliding of soils,

(4) Soil and water adjustments required to establish and maintain vegetative covers for the land,

(5) Potential soil and water contamination, and

(6) Seismic stability of the facilities.

e. Surveys must be made in areas being developed where sufficient information is not available to firmly establish the character of the soils or to form a basis for the prescribed control measures. The installation must maintain records of the surveys. A summary of such ancillary investigations should be attached to the PER when the actual studies are not included,

f. OMB Circular No.A-94 (for hyperlink see paragraph 3.16), Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, requires that a lease-purchase analysis be made when a decision has been made to lease or purchase (construct) general-purpose real property,

g. The PER must also indicate that coordination required by EO 12372, Inter-governmental Review of Federal Programs, has been accomplished or, if not, the basis of exception. Note: a fully circulated Environmental Impact Statement or Finding of No Significant Impact/Environmental Assessment with reasonable opportunity to comment satisfies the coordination requirement, and

h. If prior investigations or studies, in addition to those listed above, are used in support of the facility project, a summary should be attached.

3.20 Guidelines for Preparing Minipreliminary Engineering Reports

A Mini-PER can be prepared for some facility projects that are not sufficiently complex to warrant a full PER. The Mini-PER should include the project scope, basis of need (justification), cost estimate, project schedule, and simple schematic drawings in the same format as a PER.

3.20.1 Format and Content. The Mini-PER consists of expanded Forms 1509 and 1510 providing more information developed through engineering evaluation and study.

3.20.1.1 NASA Form 1509. The information on the NASA Form 1509 used in the budget processes describes the facility project, outlines the scope, explains the basis of the need, includes a schedule, and discloses the related resources needed to provide an operable facility to meet the advocate/user requirements. In preparing the Mini-PER, this 1509 is expanded based on an engineering study of the requested project and prepared in accordance with the instructions in Appendix C, Forms and Instructions. The study should consider at least the following:

a. Are there other cost-effective options to satisfy the requirements?

b. Is the proposed project scoped properly to meet the advocate/user requirements?

c. Does the proposed project meet safety, environmental, and master plan requirements?

d. Should the basis of need be expanded/revised to present additional information?

e. Is the schedule realistic for the proposed project?

f. Are there additional related costs that should be included?

3.20.1.2 NASA Form 1510. The cost estimate on NASA Form 1510 normally has limited detail. The Mini-PER should update the 1510 cost estimate based on the 1509 prepared from the study results, and provide additional details on quantities and unit costs for the project elements. It should be prepared in accordance with the instructions in Appendix C, Forms and Instructions.

3.21 Current Cost Estimate (CCE)

3.21.1 Developing the CCE. The CCE for a project or subproject is the anticipated cost based on the progress of planning, design, or construction. It is intended to reflect the best professional analysis of the probable ultimate cost at the time of estimate preparation. As the project proceeds, the ultimate cost will be updated to incorporate project changes.

3.21.2 The use of lump sum amounts should be avoided. The CCE used by the Center in submitting the project in the budget year CoF program is critical because that estimate normally goes into the Agency's budget submission and is subject to review by senior management, OMB, and Congress. Once a project has been submitted to Congress, the CCE cannot be changed without Headquarters approval.

3.21.3 During final design, a cost estimate is required for the 30-, 60-, and 90-percent reviews. The FPM must ensure that the CCE, based on the final design, does not exceed the approved or budget amount.

3.21.4 The next major update of the CCE occurs after bids are received and the NASA Form 1579, Flash - Bid Report, is prepared and sent to Headquarters.

3.21.5 Engineering Estimate (EE). The cost estimate for a facility project includes the current local cost of the following items, which constitutes the engineering estimate (see paragraph 3.19.3.1 for additional EE detail) with allowances added per paragraph 3.21.6, Allowances.

a. Land acquisition,

b. Site preparation, utilities, and/or access roads,

c. Construction materials and labor. In general, items such as conduits, raceways, cable trays, ductwork, wall penetrations, terminal rooms, junction and terminal boxes, which are permanently affixed, are included in the EE of the project,

d. Material and equipment tests performed at the construction site or at an offsite location,

e. Construction management services including network diagrams,

f. Environmental protection,

g. Collateral equipment,

h. Subcontractor and general contractor overhead and profit, and

i. General conditions, bonds, taxes.

3.21.6 Allowances. The following allowances are added to the engineering estimate to produce the CCE.

a. Cost growth (cost adjustment) - a percentage, compounded annually to the scheduled midpoint of construction, is normally used because projecting material, labor, and equipment costs years in the future entails uncertainty. The percentage used is applied to the engineering estimate and is determined by going to the OMB Web site and obtaining their projected inflation rates (currently found here). If higher rates for cost growth are needed to reflect local conditions, they must be explained as part of the estimate.

b. Contingencies - generally, 10-percent is used for routine work and is applied to the engineering estimate and the cost adjustment. In high-risk situations, a greater percentage may be appropriate. The specific figure used must be justified by an analysis of the risks involved, and the supporting rationale must be included in the submission documentation. A few samples of high-risk situations are the following:

(1) Incomplete site investigations,

(2) Uncertain environmental control requirements,

(3) Lack of land appraisal, and

(4) Incomplete definition of equipment to be installed.

c. SIES - typically, 5 to 10-percent is allowed for SIES and is applied to the engineering estimate, cost adjustment, and the contingency amount. The percent figure is a total of supervision, inspection, and engineering services. The supervision and inspection funds are used to provide the necessary controls and management during design and construction. The engineering services funds provide such things as as-built drawings and facility system O&M manuals.

d. Other burden costs - costs in this category must be fully explained and justified in the budget submission documents. This category includes the costs for construction management services that are provided by contract.

3.21.7 CCE Computation. The CCE is computed from the following formula that is compatible with Form 1510:

CCE = EE(1.00+CA) + [EE(1.00+CA)]C+ {EE(1.00+CA)+ [EE(1.00+CA)]C}SIES+OBC

Where:

CCE = total current cost estimate (Total Budget Estimate) for the aggregate project.

EE = engineering estimate.

CA = cost adjustment percentage factor expressed to 2 decimal places compounded from the date of the estimate preparation to the projected midpoint of construction.

C = construction contingency percentage factor expressed to 2 decimal places.

SIES = supervision, inspection, and engineering services percentage factor expressed to 2 decimal places.

OBC = other burden cost (excludes Center administrative and overhead cost) such as refurbishment of GFP.

EE (1.00+CA) = bid estimate for aggregate project.

3.22 PDRI Evaluation and Scoring

Prior to the "Go/No Go" decision for final design, a PDRI evaluation and scoring must be made in accordance with paragraph 3.8, PDRI, to confirm that no significant information is missing and to verify the project is sufficiently defined. Any missing information must be provided prior to start of final design or provisions made in the design stage to provide the information.

3.23 Facility Project Management Plan

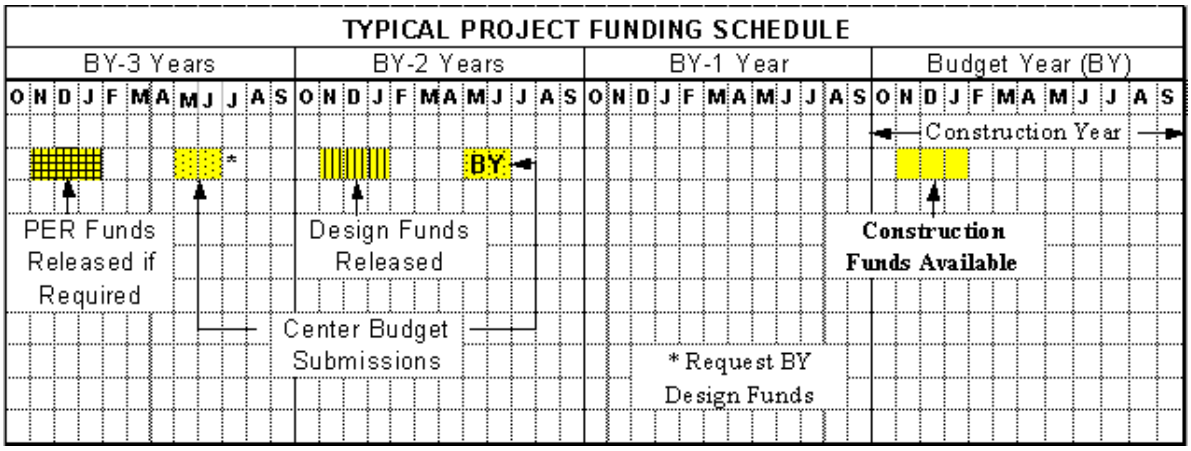
The Facility Project Management Plan establishes a realistic schedule for implementing a facility project and assigns responsibility and authority for various actions. The FPM, working in concert with the preproject planning team, is responsible for ensuring the Facility Project Management Plan is prepared when required. The plan provides a detailed outline of the steps in the facility implementation process with well-defined milestones to measure progress.

3.23.1 Application.

3.23.1.1 The management plan provides the information on resources and time-phased actions that allow the FPM to direct the project and assess the impact of management decisions. It sets forth specific tasks, schedules, guidelines, and other materials developed to the extent needed to control the project work. It serves as the principle tool for determining the progress of the work and establishing the priorities for the allocation of resources during the budget, design, construction, and activation phases to ensure the ontime completion of the project.

3.23.1.2 Prior to start of final design work on discrete projects, the FPM should present a management plan for approval to the Center official exercising project approval authority. The management plan may be informal (i.e., material contained in the project file) or developed as a formal document. For projects of $5 million or more, a formal management plan is required and must be submitted to Headquarters FED for approval. Management plan approval on projects of $5 million or more is required before start of design, therefore schedules provided in the plan should include sufficient lead time to obtain the necessary approval to preclude delaying the start of design.

3.23.1.3 The project schedule in the management plan must allow adequate time for design, reviews, procurement activities, construction, and activation. The projected release date for the solicitation package is determined either by backing off from the facility need date or by determining the date of CoF funding. Funds are available each year in the November to January time period for the FY starting October 1. If a PER is required for a project, PER funds are usually released to the Centers after the budget has been submitted to Headquarters 3 years (i.e., November to January following the May/June Center budget submission) prior to the planned construction year. Design funds are usually released to the Centers after the budget has been submitted to Headquarters 2 years (i.e., November to January following the May/June Center budget submission) prior to the planned construction year. See Figure 3-2, CoF Project Funding Schedule, for a graphic presentation of the funding process.



3.23.2 Content. The management plan will include the following as applicable:

a. Identification of the FPM and other individuals or organizations responsible for project implementation,

b. Description of the functional requirement including the operational need date and, if required, the schedule for joint or beneficial occupancy dates,

c. Description of the planned facility including capacity, scope, location, special features, CCE; and, for projects that involve less than the total requirement, the incremental phasing schedule and rationale,

d. Identification of all environmental and safety requirements,

e. Development of an acquisition plan ensuring the funding method supports the operational need date(s),

f. Specific Pre-Advertisement Review (PAR) procedures designed to assist tracking of the progress of the development of the solicitation package and completion of the checklist (NASA Form 1580, Facility Project Pre-Advertisement Review Checklist),

g. Network or bar-type charts depicting a time-phased schedule with intermediate milestones for the following:

(1) Program requirements identification,

(2) Program schedule,

(3) Translation of program requirements into project/facility criteria, description, and concept,

(4) Project justification,

(5) Alternative project site analysis and selection,

(6) Preparation of the Environmental Impact Statement (EIS) or Environmental Assessment (EA) or Finding of No Significant Impact (FONSI),

(7) Development of facility EE,

(8) Development of budget cost,

(9) Development of outfitting cost,

(10) Development of maintenance cost,

(11) Inclusion in budget 5-year plan,

(12) Major project approval for PER,

(13) PER,

(14) Request for design funds,

(15) Selection of design agent,

(16) Design,

(17) Development of operation and maintenance plan,

(18) Development of Facility Safety Management Plan,

(19) Final budget submit,

(20) Congressional action,

(21) Submittal of the PAR Checklists,

(22) Request for construction funds,

(23) Construction, and

(24) Activation/outfitting.

h. Configuration/change control procedures for the following:

(1) Planning phase,

(2) Budget phase, and

(3) Construction phase.

i. Reporting requirements,

j. Progress review program to include the various design reviews and the PAR,

k. Description of required documentation together with date required and responsible office,

l. Resources release and fiscal control procedures,

m. Appendices to the Management Plan are as follows:

(1) Requirements document,

(2) Design Management Plan,

(3) Program Assurance Plan,

(4) Acquisition Plan,

(5) Construction Management Plan,

(6) Activation Plan, and

(7) Configuration Management Plan.

3.23.3 Facility Project Special Reporting.

3.23.3.1 The management plan will identify the need for project status reporting. In addition the Headquarters Director, Facilities Engineering Division, or the Center official exercising project approval authority, may identify other specific projects requiring status reporting. The amount of detailed information in the report increases as the project progresses through the budget, design, construction, and activation phases.

3.23.3.2 The emphasis in the report is to provide an analysis of the status and estimated cost during the planning and budget phases. No change in report format occurs as the project progresses and the report is expanded to include information on the status of design, construction, and activation of the approved facility project.

3.23.3.3 The report will consist of narrative analysis/comments of pertinent facts and financial data as may be applicable based on the current project implementation phase, planning, design, construction or activation. The content of the report should include the following:

a. Date of report,

b. Project name,

c. CoF program year,

d. Project manager name,

e. Budget amount (Presidential),

f. Design start date,

g. Design finish date,

h. Percent design completion,

i. Current cost estimate,

j. Construction authority,

k. Construction start date,

l. Construction finish date,

m. Percent construction complete,

n. Total obligation, and

o. General notes, comments, or descriptions of key issues.

3.24 Planning for Start of Final Design

From the requirement definition through the concept studies, the environmental analysis process, the development of the management plan, and preparation of the PER, questions are raised or problem areas are identified. These issues may be managerial or technical in nature and they should be resolved prior to start of final design to preclude false starts and/or expensive redesign with attendant cost and schedule problems. The resolution of these issues is performed by the project advocate/user for problem areas that are part of the functional requirement and by the FPM for problems that are part of the facility project engineering and construction phase. In both cases the preproject planning team is an integral part of the problem resolution process. The results of the problem resolutions should be incorporated into the facility criteria, the PER, or the final facility design as appropriate.

3.24.1 Managerial Considerations. The completed Requirements Document/PER should be adequate as a definitive criteria package that can be furnished to a designer. Some unresolved issues that may require the attention of the FPM are as follows:

a. Overall timing of the design and construction versus the established need date may be critical,

b. Consistency with inhouse project/construction management capabilities; or, should the Corps of Engineers or some other design/construction agent be considered and the necessary funding identified. Historically, facility projects have problems because adequate management resources are not applied early enough,

c. Expensive and/or long-lead time items may need Government Furnished Property (GFP) action (see discussion below),

d. Use of multiple bid packages versus a single large package and the potential impact on the cost, schedule, and scope of the required project management effort,

e. Identification of multiple bid packages and interfaces controlled,

f. Relative timing between packages and the need for interior milestones,

g. Elements of project costs not to be included in the engineering cost estimate but essential to project completion such as outfitting and noncollateral equipment and associated testing,

h. Potential real estate acquisition or leasing arrangements (covered by NPR 8800.15A, Real Estate Management Program Implementation Manual),

i. Potential cost reductions by use of Value Engineering techniques, and

j. Related future requirements or costs that may result from the proposed project.

3.24.2 Technical Considerations. The planning activities and/or the PER may identify problems or options relating to some of the technical considerations that should be addressed prior to start of final design such as the following:

a. State-of-the-art investigations relative to materials, methods, applications,

b. Provisions for alternate energy sources for reasons of reliability, economy, and/or pollution control,

c. Need for special investigations pertaining to hazards (including health), pollution, and safety features, and

d. Need for soil borings, surveys, and other site condition investigations.

3.24.3 GFP. Many facility projects include large or complex equipment components that may cause the following if furnished to the construction contractor:

a. Significant cost savings,

b. Avoidance of schedule problems, and

c. Usage of surplus Government stocks.

In order to take full advantage of such opportunities, it is essential that the FPM use the early planning effort to identify those high-cost and/or long-lead time equipment items when direct procurement by NASA would provide distinct advantages during the construction of the project.

3.24.3.1 When GFP refurbishment or fabrication work will be accomplished by contract, the possibility of accelerating the delivery schedule should be studied. It may be feasible to provide an alternative in the Invitation For Bid (IFB) that would allow early accomplishment and delivery of the GFP item well in advance of the scheduled date for the installation work. The alternative for early delivery may encourage proposals from potential contractors who could use the flexibility in scheduling the GFP work to reduce their bids.

3.24.3.2 In proceeding with a plan for early delivery of GFP items, arrangements must be made for storage in a Government facility until the scheduled installation date. Other important GFP considerations are as follows:

a. Timely availability,

b. Refurbishment costs,

c. Relocation costs, and

d. Reimbursement expenses (if any) from another Government agency.

3.24.3.3 NPR 4200.1, NASA Equipment Management Manual, contains the procedures for establishing the availability of equipment from within the NASA inventory. Contact the General Services Administration's local or regional office, and review the current Excess Property Catalog or Bulletin for equipment that would be available from other Government agencies.

3.24.3.4 GFP items, whether a new purchase or a transfer of excess from existing Government resources, will be described in the project documents and its recorded value used in record documentation.

3.24.3.5 The FPM must closely supervise the GFP process and place particular emphasis on the following to ensure that items obtained from existing Government resources are:

a. Subjected to a hands-on-physical inspection to verify availability, condition, and the extent of required refurbishment or modification work,

b. Processed in accordance with the established schedule for furnishing these items to the installation contractor, and

c. Subjected to followup physical inspections immediately prior to the scheduled transfer to establish location, conditions, and date for delivery to the installation contractor.

CHAPTER 4: Design

This chapter provides guidance for managing the design process, obtaining A-E services, developing the design criteria package, and preparing, reviewing, and approving the final design. The guidance will help project managers produce accurate, and complete final designs, including plans and specifications, for constructing a given facility project. In those instances where the project is to be accomplished by a design and build type contract the Contracting Officer (CO) should be consulted for guidance concerning the applicable A-E procurement process. The design guidance contained in this chapter is applicable to all facility design work regardless of the procurement process used to obtain the design. See Figure 4-1, Design Checklists, for a graph presentation of the design process.

4.1 Public Release

The FPM shall ensure that organizations and personnel involved in preparing the design know that information or work products are not released to the public or other persons without a need to know and that contracts with A-Es or others contain similar limits. Public release of information in a design is to be made only by the appropriate Government officials. The design package will not include any classified information. Any necessary classified information shall be submitted separately.

4.2 Management of Design

4.2.1 Start of Final Design.

4.2.1.1 In the case of CoF-funded projects, how early to start designs requires a judgment in each case that considers the risk of expending resources versus the likelihood of the project being authorized and funded. The objective is to have designs underway on most discrete projects to ensure Congress that the cost estimates and implementation schedules are substantially in order. Also NASA policy requires "Early fiscal year award of all construction projects approved and funded in the year that construction resources are received." (see NPD 8820.2A, Design and Construction of Facilities) which means designs must start early to support this policy. On projects where a Preliminary Engineering Report (PER) was prepared the PER may serve as preliminary design work with final design starting at completion of the PER. In addition to adhering to policy, early completion of design provides some additional benefits including the following:

a. Updated CCE (see paragraph 3.20, Current Cost Estimate), based on significant design progress that is available during congressional reviews, will confirm that the facility project cost estimates and execution schedules are valid.

b. Early release of the solicitation documents coupled with sufficient bidder response time can contribute to more responsive and competitive bids for construction work.

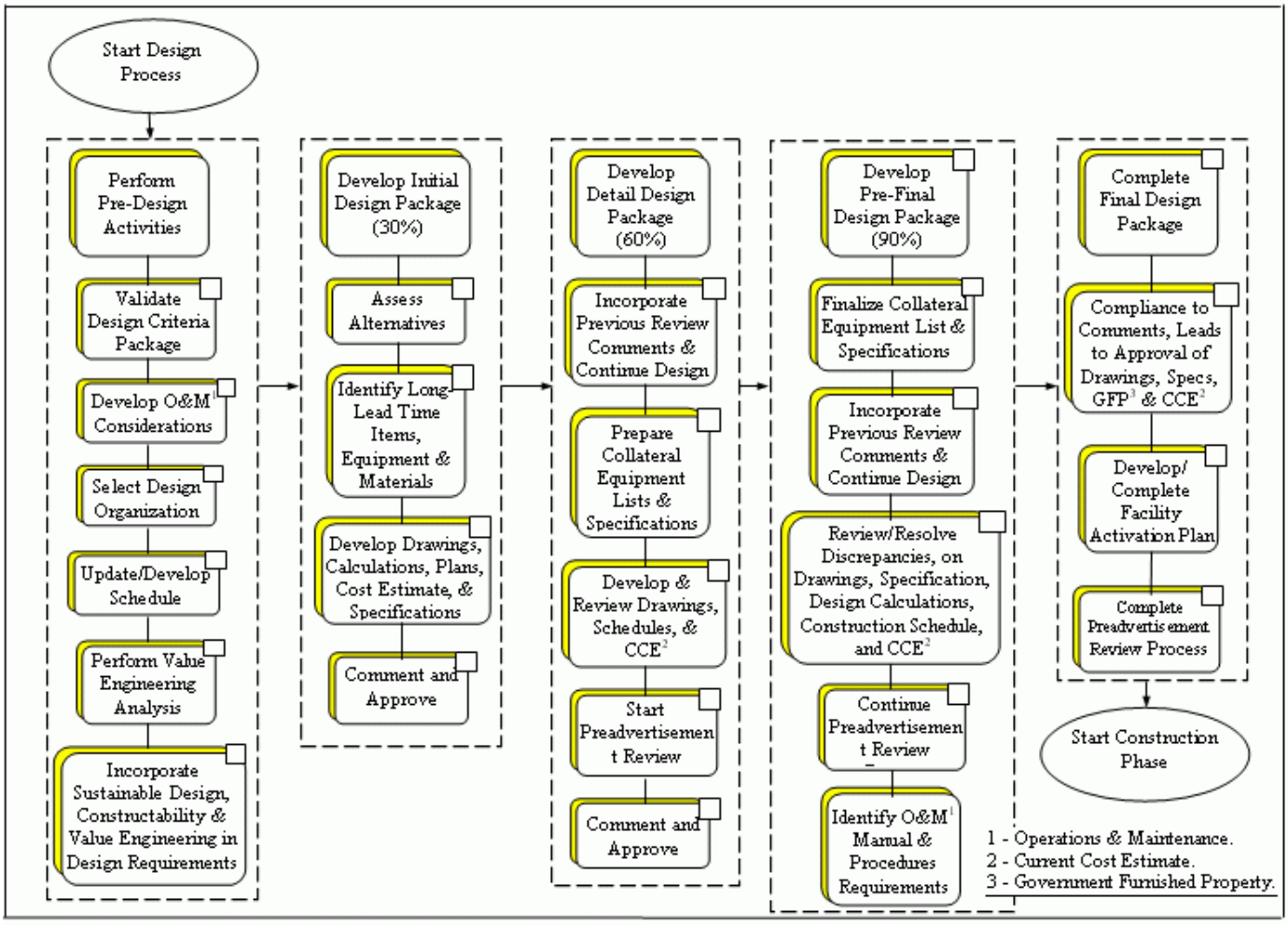


Figure 4-1 Design Checklists

4.2.1.2 Prior to the start of final design, during the design, and when preparing the bid package, the need for multiple work packages should be considered. Usually individual designs and construction work or bid packages include an entire operable facility but, in some cases, it is advisable to segregate portions of the total project scope into separate packages. The purpose of multiple work packages should always be to provide better project control that can lead to a cost or schedule advantage. The FPM should be reasonably sure that the advantages outweigh the added design and procurement effort and the potential interface problems between two or more contractors performing either in parallel or sequentially on the same construction site. Some considerations that affect the decision for multiple work packages are the following:

a. The sheer size of a single package versus the financial and management resources of potential bidders might restrict competition.

b. Use of multiple packages may alleviate concern about meeting program milestones by getting an early start on activities like demolition, site preparation, access roads, procurement of long-lead time items, and/or utility services while design of the balance of the facility is being completed.

c. Establishment of firm physical interfaces for specialty items such as bridge cranes and other collateral equipment may allow the items with substantial lead times to be contracted separately and early enough to offset long-lead time.

d. Breakout of mechanical, electrical, plumbing, and other such items that are normally subcontracted into separate bid packages could result in cost savings by avoiding the general contractor's overhead and profit. However, the Government takes full responsibility for successful implementation.

e. Isolation of difficult work to avoid delays in the balance of the project.

f. Late modification of requirements may result in added contract scope that can be separately defined. It may be a separate or additive/deductive item (see paragraph 4.4.2, Additive or Deductive Bid Items) package that can be

included in the IFB for the project. This additive/deductive item would be picked up only if the approved funds cover both the basic scope and the additive/deductive item. Thus, with favorable bids, the total requirement is satisfied without the necessity for reprogramming and/or delayed completion.

g. If multiple year funding is planned or directed for the construction work, multiple work packages may be appropriate. These can be either options (see paragraph 4.4.3, Options) or separate bids.

4.2.1.3 Prior to start of final design work, the FPM must have the following as appropriate:

a. For CoF-funded projects, guidance, direction, and FP&D funding from the Headquarters Director, Facilities Engineering Division,

b. For discrete projects, a Facility Project Management Plan per paragraph 3.22.1.2,

c. For non-CoF funded projects, a properly approved NASA Form 1509, Facility Project-Brief Project Document, and

d. A completed PER, if one was authorized for the project.

4.2.2 Staffing Needs.

4.2.2.1 A Center FPM must be appointed to be responsible for ensuring the functions required to provide a complete facility project design are accomplished prior to the construction contract advertisement date. The FPM guides the preproject planning team that includes representatives of customer, design, and O&M organizations, and other stakeholders as appropriate, although any of the stakeholders may act as the team leader. The team will support the facility project design process through the 35-percent design review by ensuring the criteria and documentation used to start the design include all pertinent requirements, and by reviewing and providing comments on the 30-percent design package. The preproject planning activities end at the 35-percent design but members of the team usually continue to support the design effort.

4.2.2.2 The various functions such as clarification of requirements and design reviews that are required to support the design of a facility project should be provided by appropriate members of the facility project team. This team includes both the Center Civil Service facility staff and qualified support contractor personnel. During the design phase, the construction management team including the Contracting Officer Technical Representative (COTR) and construction manager should be appointed in order for these individuals to be involved in, and become familiar with, the technical aspects of the project's design and the contract documentation.

4.2.3 The FPM must ensure the design complies with the scope outlined in the authorizing documents. The FPM must also ensure the designed facility meets the current advocate/user requirements, and that the functional and regulatory requirements of EO 13123, Greening the Government Through Efficient Energy Management, are met at the lowest overall life-cycle cost. The FPM should ensure the design and the CCE are concurrently developed and continually reviewed to avoid the delays that result when construction estimates exceed the authorized project amounts.

4.2.4 Early Design Process.

4.2.4.1 Early coordination of all facility projects with the in-house environmental staff and Occupational Health Office ensures timely assessment and preparation of required environmental permits or reports as required by environmental regulatory agencies. This should occur in the planning and/or development phases of the project. This coordination should be confirmed by the FPM at the start of the design phase. If it has not occurred, the FPM must expedite this coordination.

4.2.4.2 During the CoF budget process, the Headquarters Director, Facilities Engineering Division, will inform the Centers and related Program Offices, which proposed projects are supported by Headquarters. When ready the Centers may request design funds (NASA Forms 1509 and 1510 for each project must accompany the request) for Headquarters-supported projects. Generally for discrete projects, the request follows approval or is concurrent with a request for approval of the Facility Project Management Plan (see paragraph 3.22, Facility Project Management Plan). Centers may perform some preliminary contracting actions, but may not award the design contract until FP&D funds are received from the Headquarters Director, Facilities Engineering Division. For non-CoF (see Figure 2-1) funded projects, the Program Office or local funding source must authorize design funds. These funds are released based on a specific request for design funds or at the time of project approval.

4.2.5 Operations and Maintenance Considerations. The FPM, in coordination with the O&M preproject planning team member, should ensure that operations/maintenance considerations are developed ahead of or concurrently with the facility design effort. Policy and guidance for proper consideration of maintenance issues and requirements are provided in NPR 8831.2, Facilities Maintenance Management. The identification of the O&M considerations should

have a milestone completion date that coincides with the 60-percent design review. The 60-percent and 90-percent designs should incorporate the considerations as appropriate.

4.2.6 For discrete CoF projects, the FPM must review/update/expand the project's schedule in the project's management plan in accordance with paragraph 3.22.1.3. For CoF minor program or non-CoF funded projects, a schedule allowing adequate time for design, reviews, and procurement activities must be developed and maintained throughout the design phase. See Figure 3-2, CoF Project Funding Schedule, for normal design and construction funds availability dates for CoF funded projects.

4.3 Architect-Engineer (A-E) Services

Facilities Design Services are provided to most NASA Centers by several methods. These methods include the use of in-house A-E services, task ordering for contracted Indefinite Delivery/Indefinite Quantity (IDIQ) A-E services, and procurement of A-E services on a project-by-project basis through a source selection process. Any of these methods may be used to provide the same outcome: a complete design package that can be constructed with either "in-house" construction resources, or an "outside" construction contractor.

4.3.1 Regardless of which method is used to secure design services, the FPM must develop and provide to the A-E a statement of work for the specific design effort that should include a description and scope of the project, a copy of the project's 1509/1510, any project management plans that were developed for the project, a copy of the PDRI, PER, studies, any other project documentation, and the engineering estimate for the project (see Paragraph 3.19.3.1, Engineering Estimate) to be designed. The A-E must understand that this is the maximum cost of the construction contract including contractor mark-ups and overhead.

4.3.2 The following paragraphs describe the various methods of obtaining A-E design services.

4.3.2.1 Onsite A-E Services. Most Centers have resident, onsite contractor A-E services that include planners, architects, and engineers on a long-term contract basis. These firms may have only an A-E services contract, or an A-E services contract that includes any number of facilities services such as Operations and Maintenance, Logistics, or other support. These onsite resources can be a good source for A-E services because most of these contractor organizations are staffed with personnel with corporate knowledge of the Center's facilities, knowledge of previous modifications to those facilities, and a working understanding of the organizations that occupy those facilities. Knowledge of the facilities enables the A-E contractor to provide accurate designs with the least amount of disruption to the occupants because the designers have better access to information regarding facilities and missions associated with the facilities. A-E services from these contractors are typically obtained by providing funding and a Task Order against their existing contract. The Contracting Officer can provide guidance to the FPM on the process to use in securing these services.

4.3.2.2 IDIQ A-E Services. Some NASA Centers have in-place contract(s) with a single (or multiple) A-E firm(s) on an IDIQ basis. An IDIQ A-E contract is usually awarded once every few years and provides the FPM with contracted A-E firm(s) that are available on an as-needed basis with pre-negotiated rates, specified contract duration, and minimum as well as maximum contract monetary limits. The contract COTR will provide the FPM or Program Manager with assistance in selecting the firm for the specific design work and guidance on the process to use in securing the A-E services.

4.3.3 Procurement of Architect-Engineer (A-E) Services.

4.3.3.1 A-E professional services contracts employing a source selection process are normally awarded based upon A-E qualifications, without specific regard for price or other factors. Professional A-E services mean the following:

a. Professional services of an architectural or engineering nature, as defined by applicable State law, which the State law requires to be performed or approved by a registered architect or engineer.

b. Professional services of an architectural or engineering nature associated with design or construction of real property.

c. Other professional services of an architectural or engineering nature or services incidental thereto (including studies, investigations, surveying and mapping, tests, evaluations, consultations, comprehensive planning, program management, conceptual designs, plans and specifications, value engineering, construction phase services, soils engineering, drawing reviews, preparation of operating and maintenance manuals and other related services) that logically or justifiably require performance by registered architects or engineers or their employees.

d. Professional surveying and mapping services of an architectural or engineering nature. Surveying is considered to be an architectural and engineering service and shall be procured from registered surveyors or architects and engineers. Mapping associated with the research, planning, development, design, construction, or alteration of real property is

considered to be an architectural and engineering service. However, mapping services that are not connected to traditionally understood or accepted architectural and engineering activities, are not incidental to such architectural and engineering activities or have not traditionally been considered architectural and engineering services shall be procured pursuant to provisions in [FAR] Parts 13, 14, and 15.

4.3.3.2 All contracts for professional services that have an anticipated dollar value exceeding $2,500 and not exceeding $100,000 (simplified acquisition threshold) is reserved exclusively for small business concerns and shall be set aside for the exclusive participation by small business firms (see FAR 13.003 , Policy). Any award to a large business at this value must be justified in writing to the CO. The threshold for set-asides will vary from time to time because of special law or policy changes; therefore, it should be verified with the CO. Each requirement should be evaluated with the CO and documented (updated as required) in the acquisition plan included in the management plan (see paragraph 3.23.2, Content).

4.3.3.3 Publicizing Procurement Actions. The Government shall publicly announce all requirements for A-E services. Normally, the advertisement must have been published for at least 30 days to allow time for prospective firms to respond. These requirements are usually satisfied through advertisement in the Government Wide Point of Entry (GPE). The NASA Acquisition Internet Service (NAIS) provides an electronic means of posting notices of procurement actions and automatically posts the notice to the GPE. The time needed to get an advertisement published is added to the 30-day timeframe. FPM's should account for these times in their planning and scheduling.

4.3.3.4 Selecting Architect-Engineers. Professional A-E services contracts are awarded based upon the A-E qualifications; therefore, the FPM must provide the salient characteristics and criteria of the project requirements to the Architect-Engineer Selection Board for use in the A-E solicitations (see paragraph 4.3.3.5 for criteria content). This criteria is critical for the following:

a. Publicizing the project description, selection criteria, and estimated volume range of the work that must be included in the GPE advertisement.

b. Preparing and submitting Standard Form (SF) 254, Architect-Engineer and Related Services Questionnaire, and SF 255, Architect-Engineer and Related Questionnaire for Specific Project, by the A-E firms.

c. Evaluating SF 254's and SF 255's by the selection board in arriving at their recommendations to the selection official. The criteria is essentially all the selection board can use in their evaluation.

d. Administering the A-E contract and project after award of the design contract.

4.3.3.5 Selection Criteria. See NFS 1836.602-1. The selection criteria shall include the following:

a. Professional qualifications necessary for satisfactory performance of required services.

b. Specialized experience and technical competence in the type of work required, including, knowledge and demonstrated experience in applying sustainability concepts and principles to facilities and infrastructure problems through an integrated design approach. Sustainability concepts and principles include, but are not limited to, energy conservation, pollution prevention, waste reduction, and the use of recovered materials over the immediate past 10 years (see Appendix G, Sustainability).

c. Capacity to accomplish the work in the required time.

d. Past performance on contracts with Government agencies and private industry in terms of cost control, quality of work, and compliance with performance schedules.

e. Location in the general geographical area of the project and knowledge of the locality of the project. This requirement assumes that application of this criterion leaves an appropriate number of qualified firms available given the nature and size of the project.

f. Volume of work previously awarded to the firm by NASA with the object being equal distribution of contracts among qualified A-E firms including minority-owned firms and firms that have not had prior NASA contracts.

4.3.3.6 Architect-Engineer Selection Board. See NFS 1836.602-2. An Architect-Engineer Selection Board will make the evaluation of A-E firms. For component facilities, the parent organization's board performs the evaluation with support from the component facility. The Center Director or designee (selection authority) is responsible for establishing the board, which will be composed of the selection authority and at least three voting members. Members will be experienced in engineering, architecture, construction, and procurement matters. Their duties are as follows:

a. Collect and maintain data and information on A-E firms,

b. Review and evaluate data submitted by A-E firms,

c. Conduct oral and/or written discussions with the firms recommended to the section authority for any contract estimated to cost in excess of $100,000, and

d. Prepare a report for submission to the selection authority recommending, in order of preference, at least three firms considered the most highly qualified to perform the required services.

4.3.3.7 After receiving the evaluation board recommendations, the selection authority (see NFS 1836.602-4) will then review the recommendations and subsequently take one of the following actions:

a. Approve the recommended list as submitted,

b. Rearrange the order of preference, or

c. Return the recommendations to the board for such follow-up actions as may be considered necessary.

4.3.3.8 The selection authority shall advise the board of the final action. The CO will be advised of the final action, which will serve as authorization to commence negotiations.

4.3.4 Simplified Selection Procedures. See NFS 1836.602-5. A-E services estimated to cost less than $100,000 (simplified acquisition threshold) may, under the authority of the Center Director or designee, be procured by following one of the two simpler selection procedures than the one described above.

4.3.4.1 Selection by the board. The A-E selection board will review and evaluate the interested firms. A report will then be prepared containing a list of at least three firms. Those firms, which are considered the most highly qualified, will be listed in order of preference. The report will then be submitted to the CO and will serve as authorization to commence negotiation.

4.3.4.2 Selection by the chairperson of the board. When the board decides that formal action by the board is not necessary in connection with a particular selection the chairperson will then perform the functions of the board and submit the report to the Center Director or designee for concurrence. The cognizant official will then review the report and concur, followup, or return it to the chairperson for such action as may be considered necessary. When concurrence is obtained the chairperson will furnish a copy of the concurred report to the CO, which will serve as authorization to commence negotiations.

4.3.5 Negotiations. The CO is responsible for contract negotiations. The negotiation team may include the FPM or designee and others as appropriate. Because the selection process is qualifications based, negotiations can only be conducted with the first-ranked firm. Failing agreement on price and other matters with the first-ranked firm, negotiations are terminated and the firm notified. Thereafter, negotiations will proceed with the second-ranked firm and the process is successively repeated until an acceptable agreement and contract award is achieved. In negotiating the price, the content, cost, and current value of the PER, if prepared for the project, should be considered to avoid paying twice for the same work.

4.3.6 A-E Contract Award. When NASA and the selected A-E reach mutual agreement the CO is responsible for drafting and awarding the A-E contract in accordance with the FAR. Prior to award, the FPM should carefully review the contract documentation to ensure that it fully satisfies project needs.

4.4 Design Parameters, Standards, and Considerations

Prior to starting the final design effort, the FPM must ensure the design criteria and documentation includes the applicable requirements in this chapter and has been reviewed and approved by the preproject planning team.

4.4.1 Optimum solutions to satisfy the user requirement will depend on sensible interpretation of the design criteria rather than rigid adherence to preconceived ideas or opinions. Special facility features, some of which are required by law, must be identified to ensure integration rather than appending the features late in the design cycle. Advocating the use of standard details whenever possible will speed up preparation of drawings and allow the application of the designer's time to the critical aspects of the design. Frequent interface between the user and the FPM ensures that requirement changes are identified early when they can be accommodated without major redesign. Use of design alternatives or GFP may be necessary if the CCE exceeds the approved funding. Designers occasionally utilize vendor literature when specifying equipment or components. It is important to ensure that, by using this approach, other essentially equal items that are competitively priced are not excluded by specifying some superficial feature(s) or specific manufacturer's model. Using the term "or approved equal" will minimize the problems associated with using

model numbers to establish standards of performance of equipment.

4.4.2 Additive or Deductive Bid Items.

4.4.2.1 Facility design must account for all project criteria and budget limitations. Sometimes, the use of additive and deductive alternate items is appropriate. If considered appropriate, their use must be coordinated with the CO before they are included in the design and solicitation documents (see NFS 1836.213-370, Additive and Deductive Items).

4.4.2.2 Additive or deductive bid items can be determinative and, as a result, caution is necessary. Some important factors must be considered when employing additive or deductive bid items. These are (1) each additive or deductive bid item must be an independent element of the project that does not precondition the base project (i.e., the base project must be usable by itself); (2) each bid item must be clearly within the scope of the approved project; and (3), each bid item must be coordinated with other work schedules and the project activation date.

4.4.2.3 Additive or deductive bid items are considered solely in the initial solicitation and for contract award purposes. These bid items aid in determining the appropriate contract scope within the approved Government estimate.

4.4.3 Options.

4.4.3.1 At times, options may be used in addition to or in lieu of additive or deductive bid items. An option is defined in the FAR as a unilateral right in a contract by which, for a specified time, the Government may elect to purchase additional supplies or services called for by the contract or may elect to extend the term of the contract.

4.4.3.2 Options generally must comply with the three conditions above (paragraph 4.4.2.2) for additive or deductive items but must be priced and included in the initial solicitation and the CO shall make a written determination that there is a reasonable likelihood that the options will be exercised. Use of options is controlled by FAR Part 17.2 and NFS Part 1817.2. The use of an option must be coordinated with the CO concurrent with the decision to employ the option method.

4.4.4 Sustainable Design. Executive Order 13123, Greening the Government Through Efficient Energy Management, requires federal agencies to apply sustainable design principles to the "...siting, design, and construction of new facilities." To meet this requirement the FPM must incorporate the appropriate sustainable design elements into facilities planning, and design to enhance reliability and balance facility life-cycle cost, environmental impact, and occupant health, safety, security, and productivity. The essential elements of NASA's sustainability include the following (for details see Appendix G, Sustainability):

a. Energy efficiency and water conservation,

b. Site selection to minimize environmental and transportation impact and if possible, to enhance the environment,

c. Use of sustainable materials (i.e., reused, recycled, recyclable, nontoxic, low embodied energy content, renewable),

d. Emphasis on durability and efficiency of materials and equipment,

e. A healthy environment, not limited to indoor air quality,

f. Features in support of enhanced worker productivity,

g. Design for personnel safety and security,

h. Design for decommissioning and disposal,

i. Enhanced building operating and maintenance characteristics (i.e., design for reliability and maintainability, continued efficiency, and low toxicity),

j. A philosophy that defines integrating operations and maintenance experience into the facility acquisition process (i.e., maintainable design),

k. A philosophy that defines facility operational objectives, then tests and verifies that all building systems and components have been properly installed and perform to the level intended (i.e., Continuous Building Commissioning), and

l. Design meets facility operational objectives and specifies testing and verification (see NASA's Reliability Centered Building and Equipment Acceptance Guide) to ensure that all building systems and components have been properly installed and perform to the level intended.

4.4.5 Life-Cycle Design.

4.4.5.1 A facility's life expectancy is a key element for establishing the study period required for the life-cycle cost analysis; therefore, prior to start of design, the desired life expectancy of the project must be established, i.e. permanent vs. temporary construction.

4.4.5.2 The design of Federal buildings must meet the requirements of 10 CFR Part 434, Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings. One of the requirements is that the agency shall "ensure that the decision-making process for the design of the building shall employ the methodology for estimating and comparing the life-cycle cost of Federal buildings and for determining life-cycle cost-effectiveness prescribed in subpart A of 10 CFR part 436, Federal Energy Management and Planning Programs. The FPM must ensure the life-cycle cost requirements are included in the design contract and that the requirements are met in the final design.

4.4.6 Value Engineering.

4.4.6.1 Value Engineering (VE) is a systematic application of recognized techniques that are used to determine the lowest practical overall cost of a facility. It analyzes the function as well as materials and equipment of which the facility consists. The purpose is to achieve the required function, while minimizing the overall costs, and remain consistent with the requirements of performance, reliability, and maintainability. VE is not a cost-cutting technique that will minimize the initial cost at the expense of performance, operation, and maintenance costs, or vice versa. VE must be used with caution so that performance, reliability, maintainability, and life expectancy remain constant at the level required to satisfy stated requirements. Assuming the above, any design alternatives that appear to be economically advantageous and meet life-cycle cost requirements, are to be incorporated. NASA policy concerning the use of VE is presented in NPD 8820.2, Design and Construction of Facilities.

4.4.6.2 The initial VE actions are in the planning and design process where techniques consist basically of conducting performance and cost comparisons of potential alternate methods of satisfying the validated requirement. The techniques can easily and successfully be applied by in-house personnel or contractors who are competent in the disciplines involved, are made familiar with the requirement, and are willing to explore all possible solutions without preconceived notions of how it should be done.

4.4.6.3 Tradeoff analyses performed during the preparation of the PER and prior to budget requests constitute integral parts of the facility's project management and cost-control process. PER's develop best-cost approaches while continuing VE helps further ensure that costs are minimized during the design process when detailed selections of systems, components, and materials are made.

4.4.6.4 The FPM must ensure that the designer is required to incorporate VE techniques in the design analysis in addition to the life-cycle cost requirements of paragraph 3.16, Life-Cycle Cost. In addition, the designer must be required to incorporate the requirements of EO 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition.

4.4.7 Basic Design Considerations. Notwithstanding the importance of VE and minimizing life-cycle cost, certain factors remain that the designer must adhere to. The FPM must ensure that the designer is aware of these factors that constrain the design to both minimum and maximum limits. These factors are as follows:

a. Requirements - the design must be based on the actual functional and technical requirements that have been established.

b. Scope limitations - the design must stay within the approved project scope.

c. Budgetary limitations - the design must be accomplished so that the facility can be built and made functional within the approved budget amount.

d. Construction timing - the start date, duration, and completion of construction must meet the program milestones.

e. Operability/maintainability - the design will consider and include features that foster effective and efficient facility operation and maintenance as appropriate. It should incorporate appropriate features to support the O&M use of Reliability Centered Maintenance technologies (see NASA's Reliability Centered Maintenance (RCM) Guide For Facilities and Collateral Equipment).

f. Constructability - the design drawings and specifications must be appropriately detailed showing what is to be built.

g. Master plan - the design siting and layout will conform to the approved Center master plan (see Appendix F, Master Planning) and take advantage of existing utilities and accesses.

h. Geographical location/orientation - the design shall take into consideration seismic, wind, flood, heating/cooling, and

other environmental factors.

i. Metrication - the design shall comply with NPD 8010.2, Use of the Metric System of Measurement in NASA Programs, (NPD 8010.2D) (see also Appendix F, paragraph F.3, Metrication).

4.4.8 Design for Energy Efficiency.

4.4.8.1 For new construction, the design agent shall provide written certification that the design meets or exceeds the energy performance standards as set forth in 10 CFR Part 434, Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings. For rehabilitation of existing facilities, the design agent shall provide written certification that the design of the rehabilitated facility elements meet or exceed the energy performance standards as set forth in **10 CFR Part 434 for new buildings.** The FPM should ensure careful attention is directed toward energy conservation in the planning and design stages of facility projects as this can provide major benefits to the life-cycle cost reduction of facilities.

4.4.8.2 The FPM shall ensure that designs for new facilities and renovations to existing facilities include installation of check metering as required by 10 CFR Part 434.

4.4.9 NASA SPECSINTACT.

4.4.9.1 SPECSINTACT is an acronym for Specifications-kept-intact. The SPECSINTACT system is an automated specification program developed by NASA which uses standard Master Text to prepare specifications for facility construction projects. SPECSINTACT, available for download, serves as a convenient data source for specification writers and engineers preparing construction documents and provides consistency in NASA facilities projects. SPECSINTACT shall be used for all applicable CoF projects and should be used for all other facility projects where applicable. The SPECSINTACT system has been supported and enhanced for interagency use by NASA, the Naval Facilities Engineering Command, and the U.S. Army Corps of Engineers.

4.4.9.2 The SPECSINTACT Master Text is consistent with the Construction Specification Institute (CSI) format. The format is divided into divisions and subdivided into sections that define a portion of the work or requirements. The sections are further defined utilizing the following three comprehensive parts:

a. Part 1 - General,

b. Part 2 - Products, and

c. Part 3 - Execution.

4.4.9.3 The text defines the qualitative requirements for products, materials, and workmanship upon which the contract is based. The text may also contain performance requirements. Included in the text are references to Government and industry standards. Text has been reviewed for technical adequacy, legal content, and conformance with procurement regulations.

4.4.9.4 The references incorporate the names and document numbers of various organizations and agencies that publish industry recognized standards and Government standards.

4.4.9.5 Construction specifications are part of the contract documentation pertaining to the construction of a facility. The contract documents contain the legally enforceable requirements of a project. The specifier shall use pertinent sections when preparing the construction specifications. Each section used shall be edited using only the data that is specifically applicable to the project. Sections shall be coordinated with other portions of the contract documents. The specifier shall coordinate the documents to avoid repetitious or conflicting requirements. Sections for items not covered by SPECSINTACT Master Text shall be consistent with the format and terminology used by PECSINTACT.

4.4.9.6 A SPECSINTACT Construction Specification System Technical Users Guide is available for download to facilitate the use of the system.

4.4.10 Standards for Specific Facilities. The FPM should ensure that features of a facility project that need special design consideration are identified in the design requirements. Conversely, many elements of the facility project may require minimal design analysis, with the apparent range of alternative solutions actually being limited by the Center's specific needs, conditions, and preferences. Documenting the Center's standards and preferences for frequently occurring design elements (e.g., exterior and interior finishes, space planning) can significantly streamline the design process. The resulting standardization (sometimes referred to as "local specs") will also simplify future remodeling, maintenance, and operational activities. The FPM must ensure the Center's standards and preferences are included in the design requirements.

4.4.11 Facility Design Analysis.

4.4.11.1 The design analysis includes performing calculations and investigating the basis for the drawings and specifications. Important design assumptions and other factors, including references, should be clearly explained in the calculations. Standards, codes, and any other constraints on the design should also be identified.

4.4.11.2 Failure Mode and Effects Analysis (FMEA). The design process should include FMEA's in accordance with NASA STD 8719.7, Facility System Safety Guidebook and the RCM philosophy in Chapter 2 of Reliability Centered Maintenance Guide for Facilities and Collateral Equipment, which states NASA has determined that the most economical and efficient FMEA approach is to use a combination of rigorous (formal) and intuitive analysis depending on system criticality and failure impact. Candidates for rigorous analysis include, but are not limited to, wind tunnel drive motors, supercomputer facilities, and mission support systems where single points of failure exist. In addition, a more rigorous analysis may be needed for those systems and components where the streamlined or intuitive RCM process has been utilized and the resultant reliability is still unacceptable in terms of safety, cost, or mission impact. See the referenced RCM guide for details.

4.4.11.3 If the design involves sophisticated and/or complex facilities, the design alternatives considered should be presented. Components or systems suitable for VE should be identified (see FAR Part 48, Value Engineering, and NFS Part 1848, Value Engineering, for guidance on the contracts aspects of a VE program).

4.4.11.4 At a minimum, the design analysis package should include calculations or rationale by the appropriate design discipline as applicable. The following key design elements should be addressed in a design analysis:

a. Architectural (building efficiencies) - net usable versus gross square feet or volume,

b. Emergency egress concept (fire rating of corridors, distances to exits),

c. Structural - foundation and structural load includes live, dead, wind, snow, seismic, and structural loads; as well as, special loads such as cranes or hoists,

d. Fire resistance of building construction and the occupancy separations,

e. Mechanical (HVAC) - includes HVAC loads, distribution, system type (e.g. chilled water, DX) controls, pipes, fittings, valves, pump sizes. Other mechanical items such as hoists, conveyors, other machinery, and systems would have similar analysis,

f. Electrical (power needs) - includes emergency generators for emergency power requirements, transformers, switchgear; illumination and types of fixtures, distribution, cables, and panels,

g. Fire protection systems - includes sprinklers, detectors, alarms,

h. Civil - surveys, grades, soils, pavements, site utilities,

i. Specialties - security, warning, hazard detection and protection systems, environmental controls, life-cycle costs, communications, and

j. Offsite Utilities - verify required offsite utilities are available.

4.5 Design Criteria Package

4.5.1 The design criteria package must contain all of the material that provides a thorough and complete basis for developing the final design drawings and specifications that describe the required facility project. Where a PER is included in the package, it should be made clear that it is the responsibility of the design organization to reevaluate and verify that PER design criteria and assumptions remain correct.

4.5.2 Design Criteria Package Content. For projects to be designed by an A-E, the descriptive material would be prepared before the start of the A-E negotiation process. Essentially, the same package used for A-E procurements must be available if another Government agency or the in-house facility staff is required to perform the design effort. The following should be provided in the criteria package to the CO, to another Government agency, or the in-house facility staff as appropriate:

a. A Statement Of Work (SOW) and a PER, if developed, that describes the contract deliverables including, period of performance, and any special conditions that apply. In accordance with FAR Part 36.601-3, the SOW shall require the design agent to specify the use of the maximum practicable amount of recovered materials consistent with performance requirement, availability, price reasonableness, and cost effectiveness. Where appropriate, the SOW shall also require

the design agent to consider energy conservation, pollution prevention, and waste reduction to the maximum extent practicable in developing the construction design specifications. The SOW shall require that the design/specifications include the appropriate clauses and specifications from chapter 4 of NASA's Reliability Centered Building and Equipment Acceptance Guide and shall specify the acceptable test limits for the PT&I technologies to be used in acceptance testing on various equipment and systems.

b. Special studies or analyses pertaining to siting, hazards, systems, processes.

c. The Government CCE for construction.

d. Sketches, drawings, or graphics that show intent and/or scope.

e. Soil boring logs and/or test results.

f. Functional requirement documents.

g. As-built drawings of interfaces with existing facilities or utilities.

h. Guidance on the use of the NASA SPECSINTACT System (SPECSINTACT Users Guide).

i. Environmental Assessments or Impact Statements.

j. The list of GFP items to be incorporated into the design.

k. A schedule for the design phases with intermediate completion milestones (30-percent, 60-percent, and 90-percent design reviews); and, review of content of design analyses, intermediate and final drawings, specifications, and the construction cost estimate.

l. An estimate of the cost to prepare the final design drawings and specifications. The estimate should include cost for the professional, technical, and clerical efforts, and other expenses involved in the development of the required information and documentation including all intermediate deliverables.

m. Funded Purchase Request (PR) or task order for design work to be accomplished by an A-E.

4.6 Center Design Execution

This subsection includes details of the Center management of the design of a facility project. The design effort being managed includes the preparation of intermediate through final drawings, specifications, schedules, analyses, cost estimates, and other materials needed to develop a final design package for use in constructing the approved project.

4.6.1 General Considerations

4.6.1.1 The responsibility for the facility project design phase is usually delegated to the Center FPM for actual accomplishment of the planned work. The development of A-E drawings, specifications, and related construction contract documents must meet the project criteria; and, result in a complete and usable facility that meets the physical scope of the approved project and can be constructed within the approved funding.

4.6.1.2 The FPM must reach agreements with the design agent on the following items before proceeding with the design:

a. Respective responsibilities and authorities,

b. Design review program (see paragraph 4.6.2, Design Reviews (30-percent, 60-percent, and 90-percent),

c. Organization and interfaces,

d. Explicit facility criteria,

e. Comprehensive plan and schedule for the design, and

f. Requirement for beneficial occupancy.

4.6.1.3 Management of the design phase includes the establishment of realistic schedules for the preparation and completion of the drawings and specifications, as well as reviews and incorporation of changes generated during the reviews, to ensure the functional and technical adequacy are considered to preclude overall project schedule slippage including:

a. The schedule for the preparation of the facility design should allow sufficient time for the actual design work and for reviews of the intermediate and final designs,

b. Complex project design may include a work breakdown structure and the use of a network planning-analysis system such as the Critical Path Method (CPM) to identify and resolve interface problems, establish interim and major milestones, and measure progress towards completion of the facility design, and

c. Design reviews should ensure functional and technical adequacy and reduce the potential need for change orders during the construction phase.

4.6.2 Design Reviews (30-percent, 60-percent, and 90-percent).

4.6.2.1 The number of design reviews and the times scheduled for each will vary with the size of the project and the complexity of the technical problems. In all cases, specific reviews should be designated and must include the appropriate personnel who are needed to participate, such as the FPM and Center personnel who have functional sufficiency in design, fire, health, safety, O&M, and environmental areas. The instructions for the designer should include the timing and submission requirements for each review. In addition to the scheduled formal reviews, ad hoc reviews are encouraged and should be used by the designer and stakeholders as appropriate. The assigned reviewers must be aware of their responsibilities in terms of providing meaningful written comments in a timely manner.

4.6.2.2 The conduct of the functional and technical reviews of facility project design work is normally the responsibility of the Facilities Office at the Center where the project is to be located. Procedures for the review of Center/major facility projects generally include the following:

a. Advice to the designer concerning the continuation of work during performance of the design review and the requirement that specific authorization be given to the A-E firm prior to their proceeding past a design milestone,

b. Distribution of the documents to interested agencies and/or Headquarters, if requested, before a scheduled design review,

c. Preparation of a written record of all review comments; and, when required, specific agreement and resolution of conflicting comments, and

d. Where there is a significant revision in requirements and/or limited time available for design work, ongoing reviews can be conducted with the designer. This will allow the review comments to be resolved and direction provided on an expedited basis.

4.6.2.3 The general policy for facility project design review is as follows; however, the use of equivalent commercial practice milestones (e.g., that of the American Institute of Architects - AIA) is acceptable.

a. Predesign conferences are normally scheduled when unique design features or conditions require a special effort. Furthermore, ad hoc reviews should be encouraged and used as appropriate throughout the design process.

b. Review of preliminary drawings (30-percent) includes particular attention by the Center to ensure that the design makes adequate provision for mission related functional arrangements and special technical requirements. Included in the review is the need to ensure that the design is for a facility that is economical to operate and maintain, conserves energy, incorporates sustainability, and fulfills the functional requirement at the lowest overall cost. The FPM shall ensure that the preproject planning team members participate in this review and provide their comments. At this stage, technical reviews and approvals of facility project engineering design work generally include reviews of completed preliminary drawings, design analyses, calculations, list of details, list of equipment schedules, index of specifications, and preliminary cost estimates based on reasonable alternatives. Once this review is complete and concurrence of comments is complete the design is considered to be nominally 35-percent complete in accordance with NPD 8820.2A, Design and Construction of Facilities.

c. When the intermediate drawing review (60-percent) is completed, further requests for design revisions should be limited to those generated by validated changed requirements. The 60-percent review generally includes reviews of full-size drawings and details with flag notes and equipment schedules, design analyses, calculations, redlined specifications, and a full-project preliminary cost estimate. This review should include verification that the construction of the facility, as indicated by the drawings and specifications, is practical.

d. Review of prefinal and final drawings (90-percent and 100-percent) should be done principally to incorporate all review changes. The review process is essentially complete when all pertinent comments developed during the reviews are incorporated into the design documents. At the submission of final documents and prior to being made part of the bid package for construction, the design documentation should be reviewed to verify that:

(1) The final drawings and specifications are accurate and complete.

(2) Conflicts between the specifications and the directions and notes on the drawings and other documents have been identified and resolved.

(3) Design package scope of work is in compliance with that scope of work authorized by Congress or NASA Headquarters. Deviations shall be reported and resubmitted for approval.

(4) All environmental and special use permits have been identified or approved and the design package includes any special requirements resulting from these permits.

e. After the final review (100-percent), the A-E firm shall be required to correct any deficiencies that may still exist in the design drawings, specifications, and other documentation furnished by the A-E.

f. The detailed facility project cost estimate is an essential part of the documentation for the review process at the 30-percent, 60-percent, and 90-percent design completion points. The FPM must ensure the estimated cost of the project does not exceed the project funding level, including construction costs and any applicable contingencies and field inspection costs.

4.6.3 Design Cycle Completion. The final action in the design cycle is the sign-off approval of the drawings (see paragraph 2.5.6.2), specifications, GFP lists, that are to be included in the bid packages.

4.7 Pre-Advertisement Review (PAR)

4.7.1 A PAR is the detailed analysis and verification of the documentation that comprises a proposed solicitation package for the facility project work. The PAR involves a series of meetings that should start at the 60-percent design review and proceed to the final preparation of the contract solicitation documents. The purpose is to ensure that the proposed contract documentation meets the following requirements:

a. Recognizes additive or deductive alternatives, options, or other special limitations or conditions,

b. Schedules accomplishment of the work to meet the established milestones for completion and activation of the facility,

c. Contains all the contract solicitation documentation required for the type of contract being planned (see paragraph 4.8), and

d. Provides proper interfaces for all other project contracts.

4.7.2 Early in the acquisition planning, the type of construction contract should be considered. The FPM, CO, and other appropriate personnel should make a final decision on the contract type (see paragraph 4.8, Contract Types) before the final PAR. This decision must be made in time for the necessary contract documentation to be prepared for the final PAR.

4.7.3 All contract solicitation documentation will be included in the PAR (i.e., cover letter, general provisions, special provisions, and the engineering drawings and specifications). The participants and extent of the review should be determined by professional judgment based on the nature and scope of the project. The PAR will normally be conducted by the FPM and will involve, as a minimum, work package managers, senior representatives from the involved in-house design group or A-E, the construction manager, the COTR, and a representative from the procurement, safety, and legal activities. The FPM should make provision for specialists to review specific elements of the solicitation package as appropriate. Copies of the solicitation package should be distributed to all reviewers in time for comments to be prepared and submitted prior to a PAR meeting. The intent here is for comments to be considered in advance so that final deposition may be agreed upon, in most cases, at the PAR meeting.

4.7.3.1 For each facility project, the documents provided for the PAR should include the following:

a. Design drawings, specifications, work descriptions, and procedures.

b. Cover letter to issue the IFB or Request For Proposal (RFP) and general provisions.

c. Special work conditions (see paragraph 4.7.3.2).

d. Current cost estimate (sensitive controlled information).

e. List of any GFP including schedule showing location, condition, status, and date the GFP will be transferred to the

contractor's control. This list will also include procedures that require action by the contractor to protect and account for the GFP.

f. A schedule that provides a time-phased logical sequence of activities and events that are to be accomplished and milestones to be achieved by the contractor. The form will vary to suit the complexity of the project.

4.7.3.2 Special Work Conditions. In many instances, the actual performance of work at the project site is subject to special conditions that must be considered in the development of the Government cost estimate and schedule for the construction work. Special conditions need to be identified and made part of the contract documents for the PAR. They could include the following:

a. Need for the contractor to complete certain work on a special schedule, especially when two or more contractors make parallel work efforts,

b. Work efforts that are necessary but not identified in the drawings and specifications (i.e., items of work such as construction of temporary access roads, site preparation, tree removal, work areas, trailers),

c. Pollution control during construction, dust suppression, erosion protection, or runoff control into streams, and lakes to protect flora and fauna,

d. Hazard control measures to protect adjacent facilities and/or personnel from noise, vibration, sparks,

e. Disposal of excess construction materials or debris either onsite or offsite,

f. Use of utilities or installed equipment such as cranes and elevators,

g. Safety items, security measures, and badging of contractor personnel,

h. Use of special facilities such as docks and/or rail spurs,

i. Availability of Government services, security, fire protection, emergency medical,

j. Salvageable equipment or materials to be removed, stored, refurbished, or prepared for disposal, and

k. Limitations on the movement of contractor personnel and equipment to the work site to prevent interference with previously scheduled operations or rush hour traffic.

4.7.4 Specific PAR procedures should have been included in the Facility Project Management Plan (see paragraph 3.22.2.f). The PAR information concerning the solicitation package should be recorded on Form 1580, Facility Project Preadvertisement Review Checklist, as shown in the Figure 4-1, Design Checklist. The PAR checklist should be prepared in accordance with the instructions shown in Appendix C, Forms and Instructions, at the first PAR meeting and updated at each subsequent meeting. The last update of the checklist, after the 90-percent design review, must include the signatures of the participants. Authorization for the proposed procurement will be provided when the PAR and the checklist are complete; and if required, the Headquarters Director, Facilities Engineering Division, is in agreement with that planning (see paragraph 4.7.5). No package will be issued for bids that do not conform to the completed checklist.

4.7.5 The signed PAR checklist is forwarded to the Headquarters Director, Facilities Engineering Division, as a prerequisite for authorization to solicit contract proposals for the following discrete projects:

a. Projects with an estimated cost in excess of $5.0 million, and

b. All other projects identified by the Headquarters Director, Facilities Engineering Division requiring submission of a PAR.

4.8 Contract Types

4.8.1 It is NASA policy to use fixed-price contracts for all construction projects. In selected cases, an exception to this policy may be in the best interest of the Government. Approval for exceptions to fixed-price contracts must be obtained through the Contract Officer. Even with a fixed-price type contract, it may be desirable to introduce a positive or negative incentive associated with the achievement of an important intermediate milestone or completion of some element of the work on a fast-track basis. In general, contract types vary as to the degree and timing of the responsibility assumed by the contractor for the cost of performance. In addition to conventional "build to design" contracts, fixed price contracts include design-build, design-furnish-install, and two-step contracts (see paragraph 5.5.2).

4.8.2 There are basically two families (types) of contracts used in construction: fixed-price and cost-reimbursement. The specific type of contract to be used should be determined based on the degree of risk for contract performance. When the risk is minimal or can be predicted with an acceptable degree of certainty, a fixed-price contract is preferred. As the uncertainties become more significant, consideration should be given to use of other fixed-price or cost-type contracts to accommodate these uncertainties and avoid placing too great a cost risk on the contractor.

4.8.2.1 In a fixed-price contract, the contractor agrees to deliver all supplies and services defined by the contract document at the times specified for an agreed-upon price unless the contract is modified to change the work required.

4.8.2.2 Cost reimbursement contracts are appropriate when the estimated costs of the planned contract effort cannot be sufficiently determined to use a fixed-price-type contract. The Government agrees to reimburse the contractor for all costs, which are allowable and incurred in the performance of the contract.

4.8.3 The FPM and CO should seek to use the appropriate contract type under the FAR. If the solicitation is for a negotiated procurement versus an IFB, the FPM should coordinate with the CO about the exact process differences and adjust resources accordingly. For discrete projects, the FPM and CO may find it beneficial to hold a team briefing or training session in order to ensure a correct, timely process.

4.9 Facility Activation Plan

During the design process, it is the responsibility of the FPM to ensure preparation of the Facility Activation Plan. This plan should outline the steps in the facility activation process with milestones to measure progress. The plan also should identify the resources and budgets necessary to implement the activation elements.

4.9.1 Application. The activation plan provides information for the implementation of all tasks necessary to activate the facility. This plan can be informal or developed as a formal document depending on the nature and complexity of the required activation. Prior to completion of the final design work, the office exercising project-approval authority should approve the activation plan. During construction of the facility, the plan shall be updated and expanded as necessary to meet any changing activation requirements.

4.9.2 Content. The Facilities Activation Plan should include the following as appropriate:

a. Identification of the FPM and other individuals or organizations responsible for the facility's activation,

b. Description of the facility operational requirements, the operational need dates, and the schedule for facility move in,

c. Description of the activation requirements including subsystem tests, integrated systems tests, communications requirements not provided in the basic facility, furniture, noncollateral equipment, and personnel moves,

d. Preparation of budgets for all activation elements and an identification of the funding source,

e. Description of network bar-type charts depicting a time phased schedule with milestones for the following:

(1) Development of the activation plan,

(2) Plan approval,

(3) Noncollateral equipment installation (including ground support equipment - GSE),

(4) Integrated systems safety review,

(5) Integrated systems test,

(6) Operational readiness review,

(7) Facility systems training,

(8) Punch list,

(9) Data systems design and installation,

(10) Systems furniture design, purchase, and installation,

(11) Telephone installation, and

(12) Personnel move-in.

CHAPTER 5: Construction

This chapter provides guidance for the construction phase (see Figure 5-1, Construction Checklist, for a graphic presentation of the construction process) of the facility acquisition cycle that includes the following:

a. Obtaining project approval (NASA Form 1509, Facility Project-Brief Project Document) and funding (NASA Form 506A, Resources Authority Warrant) or authority to advertise prior to receipt of funds,

b. Coordinating the advertisement and award of the construction contract with the CO,

c. Managing the construction contract to ensure the facility is constructed in accordance with the contract utilizing constructability principles,

d. Preparing O&M instructions; RCM, PT&I, and CMMS information; and as-built drawings,

e. Final inspection and acceptance of the facility construction work (utilizing the Reliability Centered Building and Equipment Acceptance Guide,

f. Preparing real property vouchers and transfer documents, and

g. Final project closeout.

5.1 Construction Management Considerations

5.1.1 This chapter explains various project management methods and requirements associated with successful completion of a NASA Facility construction project. The methods presented are not all inclusive, and all methods do not apply to every project. The methods are provided as a reference to help NASA project managers successfully execute their programs.

5.1.2 Although facilities projects vary widely in scope and cost, basic management concerns apply, including the tracking, analysis, and reporting of project status and costs in accordance with the management plan described in paragraph 3.22, Facility Project Management Plan. More complex or larger projects require more involved construction management methods. Each project requires exercise of professional judgment regarding the extent to which techniques for monitoring, controlling, and reporting are advisable and cost-effective. The following factors should be considered as a minimum:

a. Dollar value of the work package,

b. Physical interfaces with other packages,

c. Unique construction criteria or techniques,

d. Need for special construction milestones,

e. Use of liquidated damages,

f. Joint occupancy during construction,

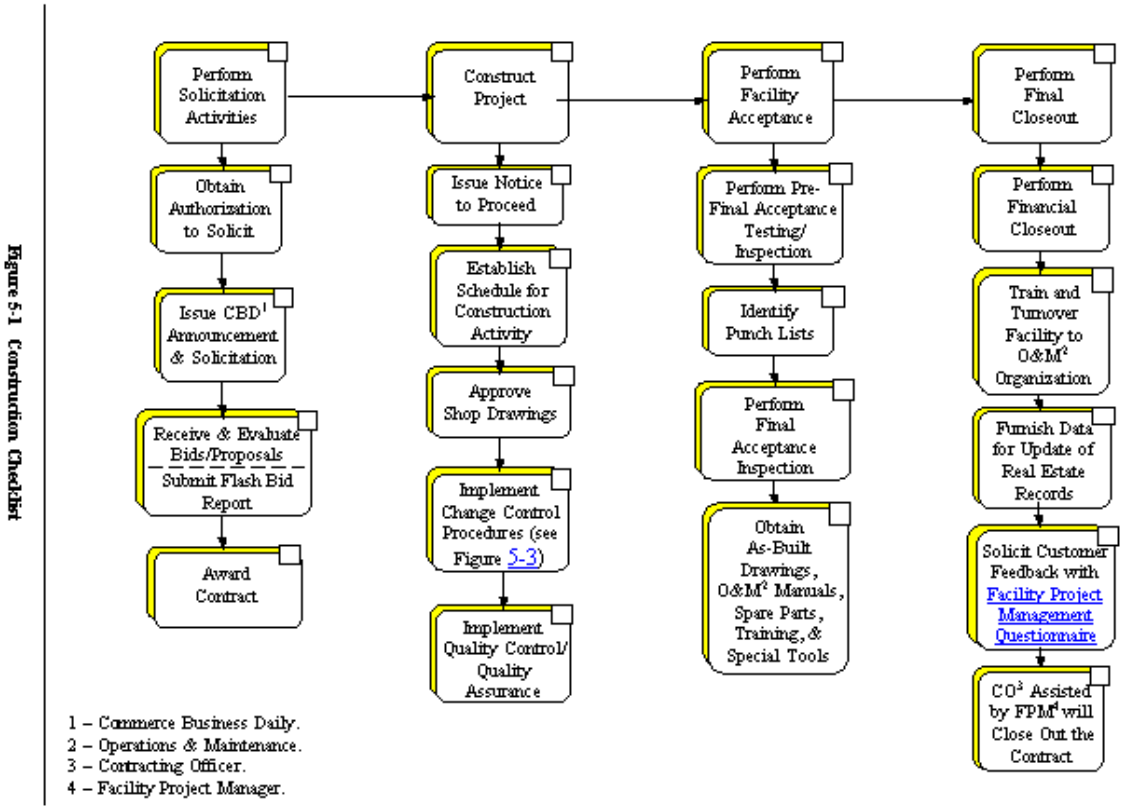


Figure 5-1 Construction Checklist

g. Project criticality to program,

h. Potential bidders' past performance experience,

i. Safety, occupational safety and health-related environmental factors,

j. Quality assurance and/or inspection method, and

k. Availability of GFP.

5.2 Bid Package

The final PAR insures that the bid package is complete and (see paragraph 4.7) includes the following documentation required for advertising the construction contract:

a. Final design drawings, specifications, work descriptions, and procedures,

b. Cover letter to issue the solicitation and general provisions,

c. Special work conditions (see paragraph 4.7.3.2, Special Work Conditions). (These should be emphasized at the prebid conference.),

d. Government cost estimate (sensitive, controlled information),

e. List of GFP, including schedule showing location, condition, status, and date the GFP will be transferred to the contractor's control. This list shall also include procedures that require action by the contractor to protect and account for the GFP,

f. A schedule that provides a time-phased logical sequence of activities and events that are to be accomplished and milestones to be achieved by the contractor, and

g. A PR providing project funding or other documentation such as a planning procurement request.

5.3 Authority to Advertise

5.3.1 No discrete or minor facility project which requires Headquarters approval may be advertised (invitation for bid or request for proposal) prior to approval of the NASA Form 1509; or the receipt of specific authorization from the Headquarters Director, Facilities Engineering Division.

5.3.2 Funds and/or authority to advertise prior to receipt of funds may be requested when the final design is 90-percent complete and the following are, or have been, provided as appropriate:

a. For discrete projects over $5,000,000 and others as specified by the Headquarters Director, Facilities Engineering Division, the following are required:

(1) Current NASA Forms 1509 and 1510,

(2) A locally approved Facility Project Management Plan as described in paragraph 3.22, Facility Project Management Plan, and

(3) A PAR checklist (see paragraph 4.7).

b. For all other discrete projects, current NASA Forms 1509 and 1510,

c. For minor projects, current NASA Forms 1509 and 1510 as required by Headquarters, and

d. For projects funded from other than CoF appropriations, current NASA Forms 1509 and 1510 and assurance that the Center has project funds or authority for the project.

5.3.3 Governmentwide Point of Entry (GPE).

5.3.3.1 Discrete facility projects may be synopsized in the GPE after receipt of Headquarters approval of the NASA Form 1509 or specific authorization from Headquarters to proceed.

5.3.3.3 Minor facility projects may be synopsized prior to receipt of Headquarters approval.

5.3.4 The Headquarters Director, Facilities Engineering Division, may authorize the continuation of the solicitation process on discrete projects up to and including the receipt of bids or proposals prior to the release of funds and subject to the Center procurement officer's approval. This is the case, for example, when a discrete project involves various work packages, each of which comprises only a portion of the overall approved scope.

5.4 Construction Contracting

5.4.1 The FPM and CO should agree on the acquisition strategy (including contract type, contract administration plans, and source evaluation method) prior to advertising the project.

5.4.2 The issuance of the construction contract is the responsibility of the procurement office. The FPM and the CO are responsible for the following:

a. Final review of the documents by all appropriate personnel,

b. Advertisement of the package in a timely and legal manner to ensure maximum competition and responsive bids,

c. Coordination of site visits and briefings for prospective bidders and responses to questions,

d. Receipt and evaluation of bids or proposals,

e. NASA Flash Bid Report (Form 1579),

f. Contract award,

g. Notice to proceed,

h. Understandings with the contractor for such items as payment schedule and shop drawing review, and

i. Liquidated damages. (FAR 11, Subpart 11.5), Liquidated Damages, states when a CO may use liquidated damages clauses in a contract.)

5.4.3 Construction Management Agents. In some instances, because of limited in-house resources, it may be desirable to use an outside agency to manage all or a portion of the acquisition of a facility. The available sources are as follows:

a. A contract for services with a construction management firm, and

b. Services available from other Government agencies.

5.4.3.1 In either of the above cases, the decision should be made early and the appropriate funds included in the project budget. The other Government agencies must be reimbursed for the services rendered, and contracting with them requires approved funding. The decision to use an outside agency for all or some part of the services associated with acquisition of a facility may be due to other factors rather than simply a lack of human resources. Specialized or unique design/construction requirements or a remote construction site are two possibilities. The decision for use of one of the other Government agencies or a commercial contract must be based on considerations of the following:

a. Cost,

b. Availability,

c. Necessary expertise, and

d. Responsiveness to NASA management's needs.

5.4.3.2 In all instances, the use of construction management services must include careful evaluation of the proposer's qualifications plus preparation of a specific and comprehensive Statement of Work (SOW).

5.5 Acquisition Process

5.5.1 The two basic procurement methods are sealed bidding and negotiation. During the acquisition process, NASA solicits offers, evaluates bids or proposals, and awards contracts. The solicitation consists of a statement of work and/or drawings and specifications, which describe the requirement, contract clauses, and solicitation provisions. IFB's are used when contracting by the sealed-bidding method and the award is made to the lowest responsive and responsible bidder on the basis of the bid price only. An RFP is used when contracting by the negotiation method when award is based not only on price but also on other factors such as technical ability, schedule, and relevant experience and past performance.

5.5.2 The following are variations to the sealed-bid and negotiated procurement methods:

a. Design-Build. These projects can be obtained through an RFP or IFB process. An SOW without specifications or drawings is provided whereby the contractor is responsible for design and construction of the project. This process is used when the project requirements are firm and the project is not of a highly technical nature. This process usually eliminates a large volume of change orders and places the majority of the risk on the contractor through use of a ceiling price. See FAR Part 36, Subpart 36.3, Two-Phase Design-Build Selection Procedures, for procurement details.

b. Design-Furnish-Install. These projects are usually negotiated through an RFP process. The solicitation package generally includes an SOW, specification, and layout of the facility. The contractor shall design, fabricate, and install the specified equipment as a final deliverable item. This method is normally utilized for an equipment related project such as the installation of a crane.

c. Two-Step. This process is an RFP. A two-step procurement includes Step 1: submission of a technical proposal and NASA determines the acceptability of each technical proposal; and Step 2: submission of bid price from each prospective contractor deemed acceptable in Step 1. The low bidder in Step 2 is usually awarded a firm fixed-price contract. This process is used for projects of a highly technical nature requiring specific knowledge or technical expertise.

5.5.3 The timing of the advertisement for bids is critical to receiving responsive bids at a favorable price to NASA. Adequate time for prospective bidders to analyze the work and prepare a competitive cost figure is essential. For small or straightforward project scopes, a 30-day bid period is usually adequate. Generally, these types of projects attract local contractors who are familiar with both the installation and local labor and material costs. For projects that are large or complex, the bid period usually should be extended to 60 days or more. The advertisement should also be directed beyond the local area to attract other than local bidders and to increase competition. Besides the time and amount of advertising exposure given the IFB, other factors that can significantly affect the bids received are the following:

a. If the local construction activity is depressed, competition should be greater. If significant construction activity is occurring, expect less competition.

b. If certain materials and/or equipment are limited because of high demand, expect inflated prices and assess schedule impacts.

c. If local labor costs are uncertain because of pending union contract negotiations and attendant problems, expect higher and fewer bids.

d. If the contract special conditions or requirements impose unusual constraints on the contractor's management flexibility, expect higher bids.

e. If the project includes specialties or trades not locally available, expect higher bids.

5.5.4 The items above generally are not controllable by the FPM. In some cases, if the conditions are recognized ahead of time, actions may be taken to reduce or offset unfavorable impacts. For example, in case of union contract problems, delaying issuance of the IFB or extending the response date beyond the likely resolution date may be warranted.

5.5.5 Contracting Officer's Responsibilities

5.5.5.1 The FPM must fully recognize that only the CO is authorized to enter into or modify contracts for supplies or services including construction. This action is done by formal advertisement, negotiation, or other authorized methods of procurement. The CO makes written appointments of the COTR and administers contracts pursuant to law, FAR, NFS, and NASA policy.

5.5.5.2 The FPM should be prepared to assist the CO regarding pricing based on the analysis of the cost to be incurred. This effort involves performing an appraisal of expected future estimates of costs. Differences of opinion between the contractor and the CO may occasionally exist. This may not only be due to projections but also due to problems with the accounting techniques on which the costs are based. Compromises are, therefore, often necessary.

5.5.6 Solicitation.

5.5.6.1 The CO, with assistance from the FPM, must prepare a solicitation synopsis for release in the GPE. The synopsis describes the tasks to be performed and informs potential bidders that a solicitation for bids is forthcoming. The synopsis must appear in the GPE no less than 15 calendar days prior to the release of the solicitation to the bidders.

5.5.6.2 The solicitation shall be publicized through distribution to prospective bidders and posting in public places. Advertising the solicitation in the GPE and other media constitutes a public announcement. As discussed above, it is important that the solicitation be publicized in sufficient time to enable prospective bidders to submit responsive bids prior to the time set for public bid opening. For anticipated construction contracts, the GPE may be used to solicit industry comments that can assist in refining the project documents and the proposed solicitation.

5.5.6.3 Typically, discrete and minor facility projects requiring Headquarters approval may be synopsized in the GPE publications upon receipt of the Headquarters approval on the NASA Form 1509 or the specific authorization to proceed (see paragraph 5.3, Authority to Advertise).

5.5.6.4 Actual solicitation of the discrete or minor project bids cannot proceed until funds are made available on the purchase request in the amount of the Government estimate. Under some circumstances, the Headquarters Director, Facilities Engineering Division, may extend program approval to advertise for bids ahead of funding. However, actual issuance of the solicitation cannot proceed until the Center procurement officer has granted permission to release an un-funded solicitation. No award may be made without funds in the amount of the low responsive, responsible bid. Exceptions to these situations occur but strict rules apply. Therefore, obtain the advice of the CO when facts suggest that it is in the best interest of the Government to proceed with a solicitation short of obligation or that an award is appropriate ahead of full funding of the project.

5.5.6.5 The solicitation documents should describe the stated requirements clearly, accurately, and completely. Unnecessarily restrictive specifications or requirements may unduly limit the number of bidders and/or result in higher bids. The intent is to attract as many bidders as possible and achieve a low price by broad scale competitive bidding.

5.5.7 Potential Bidders/proposers, Onsite Visit, and Prebid/proposal Conference.

5.5.7.1 A prebid/proposal conference will also be held with the CO presiding. The FPM responsible for the project must then appraise prospective bidders/proposers of the work to be accomplished. If appropriate, this action would include an explanation of the role and significance of this project as part of other related work. Complex or unusual work items should be explained during this conference to minimize cost impacts caused by bidder/proposers uncertainty.

5.5.7.2 Bidders/proposers are urged and expected to visit the site where services are to be performed. However, site visits are not mandatory for awarding the contract. The objective is for them to get a thorough knowledge of the general and local conditions that may affect the cost of performance of the contract.

5.5.7.3 The CO evaluates questions raised by prospective bidders/proposers and provides answers by amendments if the solicitation documentation must be modified. The CO must coordinate technical questions with the FPM.

5.5.8 Receipt and Evaluation of Bids.

5.5.8.1 The FPM should be aware that the CO (or authorized representatives) will act as the bid/proposal opening officer. All unclassified bids must be publicly opened and recorded and will be read aloud to the persons present. Appropriate security procedures must be followed in instances where project work involves items that have been assigned a national security classification.

5.5.8.2 A record or abstract with the following information shall be completed by the CO or designee as soon as the bids have been opened and read:

a. Invitation number,

b. Bid opening date,

c. General description of procurement item,

d. Names of bidders,

e. Bid amount, and

f. Other information required.

5.5.8.3 All information shall be entered into the record and the bid opening officer must certify the accuracy of the record and, accordingly, it shall be available for public inspection.

5.5.8.4 Evaluation of the bids must be made by the CO and a panel assembled by the FPM who is responsible for the project.

5.5.8.5 The preservation of the integrity of the competitive sealed bid system dictates that award of contract must be made to the responsive, responsible bidder who submitted the lowest bid. Occasionally, a reason exists to reject all bids prior to contract award.

5.5.8.6 The CO is responsible for ensuring that the bids conform to the terms and conditions of the solicitation, determine responsibility, and determine responsiveness. The FPM serves as the technical advisor to the contracting officer in making these determinations.

5.5.8.7 An element of determining responsiveness is adherence to the Buy-American Act. The Act involves presolicitation and postbid opening decisions and an appropriate clause relative to the Act needs to be included in each solicitation (see Appendix E for details). Thus, if the FPM expects the project to contain non-domestic products, it is essential to advise the CO before the solicitation is prepared and assist with the analysis of bids regarding this matter after bid opening.

5.5.8.8 Facility Project Contract Bid Opening and Award Data. For all bid packages, the FPM must provide by data facsimile, NASA Form 1579, Flash Bid Report, (see the form and completion instructions in Appendix C, Forms and Instructions) to the Headquarters Director, Facilities Engineering Division, immediately following the completion of bid evaluation and a determination is made that the bids are responsive. In the event a determination of responsiveness cannot be made within 5 working days of the bid opening, a partial report will be submitted which provides the information available, reason for the delay, and description of corrective actions which the Center plans to pursue. NASA Form 1579, Flash Bid Report, needs to be submitted only for those projects whose total estimated cost exceeds $500,000. This report must be submitted regardless of the fund source or the type of contract used.

5.5.8.9 The CO shall make the final selection of a contractor in accordance with procurement laws and regulations. This action is based on the assessment and judgment that the prospective contractor can perform successfully. In this process, the following tools are used:

a. Preaward surveys and solicitations,

b. Debarred/suspended contractor list, and

c. Previous performance reports.

5.5.8.10 The preaward survey is an important tool for ensuring that the contract award will be made to an established contractor. A careful investigation should be made into the contractor's previous contracts as to responsiveness,

responsibility, quantity of work previously subcontracted, financial stability, bonding capability, attention to health and safety of workers and the public, and other unique characteristics required for the project.

5.5.9 Receipt and Evaluation of Proposals. Proposals shall be received and evaluated in accordance with FAR Part 15and (NFS 1815), Contracting by Negotiation.

5.5.9.1 The FPM shall work with the CO in establishing the Source Selection Authority (SSA) at the lowest reasonable level for the acquisition in accordance with center procedures per the NFS 1815.

5.5.9.2 Following the evaluation process and selection of the contractor a NASA Form 1579, Flash Bid Report, shall be submitted to the Headquarters Director, Facilities Engineering Division, for those projects whose total estimated cost exceeds $500,000. The report will be filled out as though the proposals were bids.

5.5.10 Award of Contract. Prior to making the award, the CO will notify the FPM responsible for the project that the award will be made and when the preconstruction conference will be held. Award can be made after Center required concurrences have been obtained. This event may vary with different NASA Centers and type of contract. The CO makes award of the construction contract by written notice within the time for acceptance specified in the solicitation.

5.5.11 Preconstruction Conference.

5.5.11.1 The final step before the work can begin is the preconstruction conference that is chaired by the CO. The COTR may conduct the meeting. It should be held at the earliest possible date following the contract award. The purpose of the conference is to get the contractor and the subcontractor(s) started smoothly. Conference attendees are the Contractor, FPM, the designer who prepared the drawings and specifications, construction inspector(s), and other essential personnel. The list of attendees should also include the lead designer and the lead construction manager as applicable. The contractor will then become familiar with key personnel, how they operate, and establish relationships between the different parties involved in the work.

5.5.11.2 Key matters that should be discussed and clarified during this meeting are as follows:

a. Administrative instructions, correspondence routing, and authorities that may issue orders to the contractor. (NASA policies on equal employment opportunity (EEO), cost accounting practices, and other items that may be required as part of the general instructions and conditions for the contract are provided as part of these instructions.),

b. Construction schedule submissions/updates and the sequence of work,

c. Methods of construction,

d. Shop drawing and other submittal review procedures,

e. Value engineering,

f. Testing requirements, agencies, or laboratories,

g. Long-lead time procurement items,

h. Requirements for equipment storage, maintenance areas, and material layout areas,

i. Human resources, shifts, and labor matters including work rules,

j. An acceptable Safety and Health Plan submission,

k. Contract modification procedures,

l. Supplier and subcontractor arrangements,

m. Progress and payment determinations,

n. Plans and specifications interpretations,

o. Site security, personnel badging, access limitations, and parking issues,

p. Sanitary facilities,

q. Construction utilities,

r. Environmental issues,

s. Access/outage requirements,

t. Housekeeping needs,

u. Maintenance manuals required,

v. Davis-Bacon Act requirements (see Appendix E for details),

w. As-Built requirements, and

x. Partnering.

5.5.11.3 Effective preparation for and conduct of this meeting can facilitate the establishment of harmonious relationships among the various elements throughout the life of the contract.

5.5.11.4 An agenda detailing the highlights of the meeting including specifications, page numbers, and other critical considerations should be prepared in advance of the meeting. The agenda serves as the basis for the minutes of the meeting.

5.5.11.5 An accurate written record of the preconstruction conference is required. The record may be determinative for contract administration, claims, and change matters. The record must be carefully prepared and concurred with by the FPM and the CO.

5.5.12 Partnering.

5.5.12.1 Partnering as defined in NFS Subpart 1836.70, Partnering, 48 CFR Chapter 18, means a relationship of open communication and close cooperation that involves both Government and contractor personnel working together for the purpose of establishing a mutually beneficial, proactive, cooperative environment within which to achieve contract objectives and resolve issues and implementing actions as required. The Partnering process builds a proactive team founded on honor in pursuit of mutual objectives, primarily safety, quality, schedule, budget, value engineering, and dispute avoidance. The team operates in an empowered, value-based, action-oriented environment geared for success.

5.5.12.2 A workshop, usually facilitated, is held initially to establish a partner relationship. The direction and synergism of the partnership is reflected in a charter mutually developed and signed by stakeholders. The charter contains a team binding message with clear, compelling objectives. The team develops helpful structures and systems to synchronize themselves for winning. During construction, the team periodically revisits the charter and frequently measures their progress against it. Quick action is taken to overcome problems or correct communication breakdowns. The net result yields higher quality products completed quicker at lower overall costs, with fewer accidents and no litigation.

5.5.12.3 The Partnering concept has spread rapidly throughout the design and construction business. The Associated General Contractors of America enthusiastically endorses the concept. The American Society of Civil Engineers believes Partnering is returning vitality to the American construction industry lost to adversarial relationships. Partnering is the management paradigm for construction of facilities within NASA (see NASA Partnering Desk Reference).

5.6 Construction Management Decisions and Actions

5.6.1 The construction phase brings to actual physical reality the prior efforts in the planning and budget process, design preparation, and construction contract award. The Center responsibility in this phase includes construction surveillance, funds management, cost control, and coordination to expedite the acceptance and activation of completed facility projects.

5.6.2 In the accomplishment of facility project work, it is essential that the construction contractor follow the approved contract drawings and specifications and adhere to the contract work schedule. This approach ensures that the work provides a complete and usable facility that satisfies the requirement that is the basis for the original project justification. The goal is timely completion of the facility within the approved cost estimate and in compliance with the contract documents.

5.6.3 Construction Surveillance. The responsibilities of the FPM for project work include administration and inspection of the construction effort.

5.6.3.1 The important element of the administrative responsibility is to have control over the flow, analysis, and preparation of the responses to correspondence from the contractor. Emphasis should be placed on providing prompt

responses; and, when necessary, interim replies may be appropriate. These efforts involve the preparing and processing of status reports; reviewing and approving shop drawings and other submittals; processing contractor requests for progress payments and requests for information; and transmitting proposals concerning potential changes, requests for adjustment to the approved progress schedule, and other similar items.

5.6.3.2 Inspection includes the visual inspection of the construction operation (i.e., production and materials) whether onsite or offsite to ensure compliance with the terms of the contract. To assist the FPM in accomplishing these tasks, the construction management organization includes GFP managers, inspectors, engineers, architects, schedulers, analysts, and other specialists. At some of the NASA Centers, support contractors perform these functions. When the facility project documents are transmitted to the CO, one or more engineers are designated to perform the detailed Government inspection of the contract work. The FPM furnishes professional/technical advice to the CO; is responsible for the inspection of the contractor's work and interfaces with the contractor; provides engineering information; recognizes and takes action to correct improper construction work; initiates contract modifications; and establishes procedures to resolve field problems.

5.6.4 Facility Project Cost Control and Reporting.

5.6.4.1 The FPM's surveillance over facility project construction work includes the exercise of management and control of the costs for changes to the project work. A key element related to this is the maintenance of a project CCE highlighting approved and potential changes in the project cost and schedule. Particular emphasis must be placed on any changes that will require funds in excess of the approved amount to provide a complete facility.

5.6.4.2 Cost Control Sheet - a cost control sheet is required, as directed by Headquarters Director, Facilities Engineering Division, when a discrete project is segregated into separate work packages (see paragraph 4.2.1.2). The cost control sheet, depicted on Figure 5-2, Cost Control, when required is an attachment to the NASA Form 1509. It should be submitted to the Headquarters Director, Facilities Engineering Division, for approval at the time that the construction funds are requested.

5.6.4.3 The cost control sheet is designed to provide a reasonable level of program control while still allowing the Centers cost flexibility. This flexibility applies to the elements of a work package. It is possible to increase the cost of a work package provided the following apply:

a. The authorized physical scope and intent is not increased, and

b. The current cost estimate for the work package totals an amount not greater than the approved work package amount plus 10-percent or $250,000 whichever is smaller.

5.6.4.4 In the event the above conditions do not apply, the following options are available:

a. Submit a suggested revision to the distribution of the approved project amount as shown on the cost-control sheet. The redistribution can only be made on the basis of lowering the current cost estimate for one work package so that an increase can be made to the work package needing additional funds. In no case, can this be done arbitrarily but only on the basis of realistic current cost estimates.

b. If it is not feasible to redistribute, then consideration must be given to a scope redirection and recommendations should be made accordingly to the Headquarters Director, Facilities Engineering Division. Such proposals must be coordinated with the Headquarters Program Office prior to implementation.

c. In the event neither of the above two actions solve the problem, other appropriate actions will be considered by the Headquarters Director, Facilities Engineering Division, on a case-by-case basis.

5.6.4.5 It is readily seen that the validity of the current cost estimate is a key element to this total concept. For this reason, the cost control sheet is a tool, which must be realistically employed in the facility project management process.

5.6.4.6 A principal management tool for effective control of project costs during the construction phase is the systematic development and use of information on the physical and financial status of the project work. This effort is accomplished by establishing a system for tracking, analyzing, and reporting project costs; and identifying potential problems that could increase the project scope and cost and delay progress in the construction work.

Cost Control

Enter Project Title
Enter Center Name

Work Packages	Program Plan		Funds Released		
	AS OF:	THIS	THROUGH	THIS	TOTAL
Project No, *Enter Number* FY-*Enter Yr.*	*Enter Date*	REVISION	*Enter Date*	ACTION	TO DATE
Enter "WORK PACKAGE" *and Number Enter Descriptive Work Package Title*	*Enter $*	*Enter $*	*Enter $*	*Enter $*	*Enter $*
Enter "WORK PACKAGE" *and Number Enter Descriptive Work Package Title*	*Enter $*	*Enter $*	*Enter $*	*Enter $*	*Enter $*
Enter All Work Packages					
CONSTRUCTION MANAGEMENT	*Enter $*	*Enter $*	*Enter $*	*Enter $*	*Enter $*
TOTAL	*Enter Total*	*Enter Total*	*Enter Total*	*Enter Total*	*Enter Total*

This PROGRAM PLAN column above lists the work package CCEs comprising the Approved Facility Project Cost Estimate (AFPCE). Project management flexibility is provided as follows: Work Package Funds released/realigned, listed in the TOTAL TO DATE column, may be varied to a maximum of 10-percent or $250,000 whichever is smaller provided the authorized scope of work as stipulated on the latest approved Form 1509, dated *Enter Date* , is not changed. This Cost Control sheet is an attachment to the Form 1509 referenced above and reflects current authorized funding agreements for each work package of the project.

CONCURRENCE: ____ APPROVED: ____

Design and Construction Team Date Code JX Date

Change No. *Enter No.*

Figure 5-2 Cost Control Sheet

5.6.4.7 Facility project cost control - the funding for the construction of an approved facility project is provided to the Center on the NASA Form 506A in accordance with the procedures described in paragraph 2.5.3, Facility Project Fiscal Management. This funding level establishes the following:

a. The basis for the facility project financial reports, and

b. The fiscal threshold for the management of the project CCE during the construction phase.

5.6.4.8 The project CCE that is developed for use during the construction phase must be derived from a professional engineering evaluation of the work to be accomplished and a realistic understanding of costs for this type of work at this location. Equally important is the constraint to do only work that is needed to meet the facility requirement and not to modify construction contracts to include additional work simply because it is desirable or funds are available. Continuation of cost control during construction is imperative to ensure that changes in total project costs do not exceed approved funds.

5.6.4.9 During the execution of the construction work, the FPM shall progressively analyze and refine the construction cost data and the project CCE. This must be done in comparison to the fiscal threshold established by the project funding provided in the NASA Form 506A and/or Form 800/01. For instances when an anticipated increase will result in a CCE that exceeds the funding provided, prior approval must be obtained from the Headquarters Director, Facilities Engineering Division. The action to request this type of increase in the project cost should provide the following information that is normally required as a part of the change control procedures identified in the project management plan:

a. A narrative justification, which identifies and describes the requirement for the work, which causes the cost increase,

b. A summary showing the major elements of the work and their costs that are the basis for the proposed increase in the project CCE,

c. A fiscal summary showing the amount of the basic construction contract plus the cost of all contract modifications, which incorporates previous approved change orders, and

d. A summary of outstanding changes not yet approved or negotiated and the estimated cost for each.

5.6.4.10 In all instances where an increase is proposed in the original project funding provided by NASA Form 506A, the additional work must be within the original scope of the facility project or be a change that has been approved by the Headquarters Director, Facilities Engineering Division.

5.6.4.11 Facility project reporting - during the actual construction, the reporting system provides an analysis of the current physical status and approved cost for the facility and a forecast of anticipated changes in cost. The FPM will establish internal facility project management and reporting procedures that assist the local project management effort and also provide source documents for both quarterly reports as well as the monthly reports on facility projects. See FPMS) for detailed instructions on the format, content, and submission schedule for the facility project status and financial data.

5.6.5 Material and Equipment Approvals.

5.6.5.1 The FPM and the inspecting staff are responsible for the technical evaluation and recommendations concerning the materials and equipment (shop drawings) proposed for use by the contractor. The CO has final authority for approval of this material and equipment and makes the decision on the basis of these recommendations.

5.6.5.2 Prior to the start of construction, the FPM must be satisfied that the contractor has an appropriate material test program that is consistent with the schedule for the actual construction work. This test program will be the principal means of determining that the materials and equipment, proposed for use by the contractor, are in compliance with the contract drawings and specifications.

5.6.5.3 Some of the items submitted to the COTR for approval may be samples from the manufacturer with certificates from the ASTM showing compliance with contract specifications. The FPM ensures that the certificates are submitted and approved by the COTR before any use of the material is made on the construction project. An exception would be ready-mix concrete where actual samples of the delivered material are tested. The equipment items are approved on a similar basis with the addition of an operating test and submission of the manufacturer's warranty.

5.6.6 Review and Approval of Shop Drawings.

5.6.6.1 The contract drawings or specifications indicate materials and equipment which require Government approval of the shop drawings before the item is fabricated and incorporated into the facility. These shop drawings (actual drawings or catalog cuts) are prepared and submitted by the contractor for review and approval by the Government. The review must follow an established schedule so the fabrication and delivery of the item is consistent with the approved progress schedule for installing the item in the facility.

5.6.6.2 The FPM is responsible for scheduling a technical review of the shop drawings. Contractually, the approval of shop drawings is by the CO. In actual practice, this authority may be delegated in writing to the COTR who approves the shop drawings. In some cases the shop drawings may need to be reviewed by the A-E, which will increase the approval time and require a change to the construction schedule.

5.6.6.3 The FPM must ensure proper functioning of the shop drawing review system prescribed in the project management plan and take action as follows:

a. Allow sufficient time for adequate review,

b. Minimize the time required for transmitting the drawings,

c. Maintain current information on the status of the shop drawings submitted for review,

d. Coordinate with the contractor and applicable personnel on the unacceptable shop drawings or shop drawings having irregularities and/or disputes in order to minimize time delays, and

e. Identify and resolve instances where the shop drawing submission or review departs from the established schedule.

5.6.6.4 The contractor should submit shop drawings in accordance with the contract provisions as soon as possible after receipt of the Notice To Proceed (NTP). The review will be by the design engineer, occupational safety and health-related, safety and fire protection personnel, and other appropriate personnel. Where critical technical or operational considerations are involved, the users as specified in the management plan will make arrangements for a review. The contractor shall then acquire and install the required material and equipment in accordance with the approved shop drawings.

5.6.7 Project/Contract Modification Control.

5.6.7.1 The basic construction contract sets forth a scope of work with a price for that scope. After award, it may be

necessary to modify the basic contract to accommodate scope revisions caused by field conditions or design changes. The designated CO is the only individual authorized to commit or execute such changes for the Government.

5.6.7.2 The process for obtaining changes includes identification, assessment, approval, and implementation. Details of the procedures to obtain approval/coordination are included in the management plan. Headquarters Director, Facilities Engineering Division, or designee approval/coordination is required for all of the following discrete project changes/impacts prior to contract modifications:

a. Changes to the approved scope of the project,

b. Causes of significant delays in scheduled milestone dates resulting in a programmatic impact,

c. Requirement for funds in addition to those approved by the NASA Form 506A for the project, and

d. Significantly changed (20 percent) funding level specified for individual elements of project work as specified in the 1510.

5.6.7.3 Cost changes are best controlled through development of firm requirements and clearly defined drawings and specifications and in the case of an RFP evaluation and negotiation.

5.6.7.4 NASA's normal policy disallows issuing construction contract modifications before formal negotiations are concluded. Exceptions are permitted in emergency situations where delays in issuing the modification would significantly impact the project schedule, cost, or operational support. In these cases, the FPM may direct the modification in advance of formal negotiations and documentation.

5.6.7.5 The processing of proposed changes to contracts for facility project work will normally follow the guidance and direction provided to the FPM by the CO and Headquarters. This guidance provides the FPM with the basis for developing specific change order control procedures for the facility project management plan. The first step is usually the preparation of an assessment of the proposed change covering the following:

a. The advisability of accomplishing this work as a change to the basic contract. This includes inputs from the engineering staff, schedule analysts, and other appropriate personnel/activities.

b. A detailed Government cost estimate covering material, labor, and other elements.

c. Time and cost impacts to accomplish the work included in the change and the potential impacts to ongoing work. Of special concern is work that has an impact on the approved progress schedule.

5.6.7.6 Subsequent steps involve the review and assessment made by either the Change Control Board (CCB) or by designated individuals. Following the review, the CO shall request the contractor to submit a proposal to accomplish the change. The FPM and others will evaluate the contractor's proposal and the completed evaluation will be provided to the CO (see Figure 5-3, Typical Change Order Procedure, for details).

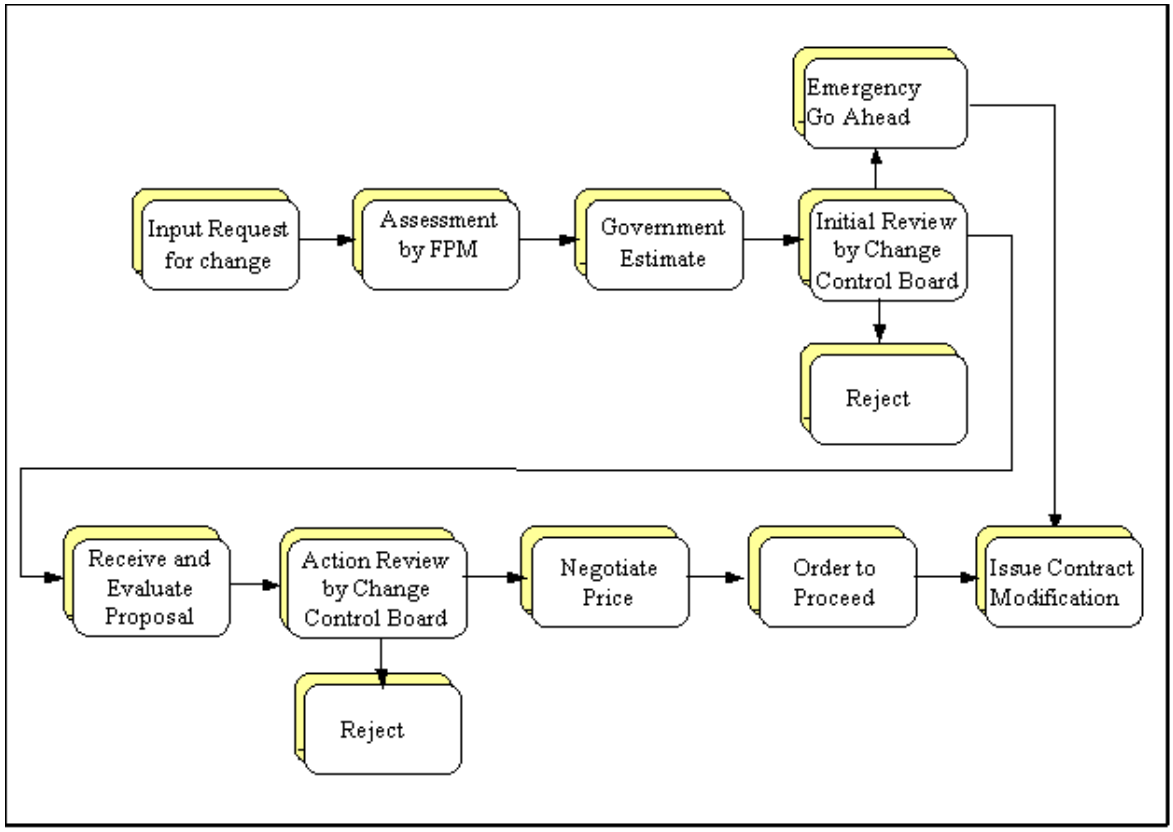


Figure 5-3 Typical Change Order Procedure

5.6.8 Network Planning and Analysis. The management of facility project work requires the use of a plan of execution showing the component activities, the work duration, and the sequence of events and milestones for the completion of various elements of work. This plan provides a schedule showing the start and completion of individual elements of work and interior milestones (i.e., benchmarks that identify interfaces with other NASA activities; establish the physical status of the work; and measure progress towards meeting the approved schedule for occupancy, completion, and activation of the facility). Network diagrammatic scheduling such as the CPM is a technique presently available for the planning, evaluation, and control of construction activity. (Note: A full discussion of networking techniques is beyond the scope of this text and a number of excellent references are available.)

5.6.9 Progress Control and Payments.

5.6.9.1 The contractor's cash flow and financing costs depend on progress payments. When the contract clearly specifies that progress payments will result only from work accomplished in accordance with the mutually agreed upon schedule as shown in the network diagram, the contractor will be motivated to do the following:

a. Keep the execution plan and schedule updated and furnished to the FPM on a regular basis, and

b. Follow the plan and schedule with a minimum of deviation in order to satisfy the critical interior milestones for interface with other activities.

5.6.9.2 Tracking actual work progress versus planned work is a combination of day-to-day physical inspections and regular (at least weekly) discussions with the contractor. The physical inspections should not be limited to the construction site alone if offsite fabrication or acceptance testing is part of the plan. Actual offsite inspection of progress is most important if a task on the critical path is dependent on the offsite activity for timely accomplishment. The tracking of the physical progress in accomplishing the contract work shall include tracking and analysis of the composition and size of contractor workforce present at the job site(s). Worker loading information provides an indication of progress by staff hours and dollars expended. The daily inspections should not simply tabulate what is in place but should also identify planned activity that is not occurring.

5.6.9.3 Proper use of progress payments is essential to avoid contractual problems. The FPM must ensure that the payments accurately reflect the percentage of work actually completed. In general, payments should only be authorized for material and equipment after it is installed. However, if an agreement exists to pay for materials and/or equipment

when it is delivered on site, the contractor shall provide adequate protection and storage for the items. The Government may also pay for materials and equipment delivered to the contractor at other locations if the specific conditions listed in FAR Clause 52.232-5, Payment Under Fixed-Price Construction Contracts, are met. Note: A significant amount of funds (e.g. 5 percent) should be retained until the work has been accepted.

5.6.9.4 Additionally, FAR Clause 52.232-5, requires the contractor to submit a certification stating that payments have been made to subcontractors and suppliers from previous payments and timely payments will be made from the proceeds to this payment. Any amounts withheld from the subcontractor or supplier by the contractor in accordance with the subcontract should not be billed to or paid for by the Government. If the contractor does not complete the certification, then payment should not be made.

5.6.9.5 Accurate, certified payroll records should be received at least monthly from the contractor and each subcontractor onsite. These records shall be reviewed to verify the crew sizes, dates of work, and wages. Any discrepancies must be brought to the attention of the CO.

5.6.9.6 Periodic, at least monthly, review meetings should be held with the construction contractor as follows:

a. The format of these meetings should be that of a formal dialogue beneficial to both parties. The FPM should schedule and chair the sessions. Attendance should include the contractor's representative who can authoritatively answer questions about day-to-day planning and progress.

b. Having a comprehensive inspection diary, the FPM can enter the review discussions each week with a meaningful agenda.

c. The discussions should start with the contractor providing answers to unresolved questions from the previous meeting plus any inputs on the current planning activity that deviates from the approved schedule.

d. The FPM should advise the contractor of those items of work which can be authorized for progress payments based on their apparent contribution to maintaining the approved schedule as shown on the network diagram.

e. Next the FPM should ask any questions arising from inspections, discuss recovery plans for deficient items on the critical path, and ask any questions about work planned for the immediate future.

f. The minutes of these meetings should be prepared and provided to all participants as soon as possible after the meeting. The purpose is to assist in providing effective future direction and to ensure timely followup action.

5.7 Construction Project Operations and Maintenance (O&M) Considerations

Facility projects at Centers are frequently complex and include extensive specialized equipment. For such projects, it is essential that arrangements be made for preparation of instructions, training of personnel, and provision for spare parts and special tools needed to operate, maintain, and repair the facility and the utility support systems. The arrangements to develop this capability are usually done in parallel with the associated design and construction effort.

5.7.1 O&M Instructions and Manuals. The Center responsible for the construction of a major facility must arrange for the development of the O&M instructions or manuals. Usually, this is an effort that extends through the design and construction phases. Provision should be made in the A-E and/or construction contract to develop the O&M instructions and provide these in electronic form as part of the completed facility project including items such as--

a. Detailed maintenance procedures,

b. Detailed operational procedures,

c. Detailed system checkout instructions and periodic tests,

d. Master equipment list,

e. Spare parts list,

f. Special tool list,

g. Additional data required to populate the Center's CMMS, and

h. Test data from the PT&I and conventional acceptance testing.

5.7.2 Training O&M Personnel. The FPM ensures that O&M personnel receive training in operating and maintaining the facility and equipment. The training must be accomplished before the final acceptance of the facility. The O&M manuals should also be provided to personnel at the same time they receive training on the equipment.

5.7.3 Spare Parts and Special Tools. When required by the contract specifications, the CO will ensure that the contractor delivers these parts and tools by the final acceptance date.

5.7.4 Operation and Maintenance Contracts. A Center should consider whether their existing or planned O&M contract includes the work required to operate and maintain the new facility. Changes to the O&M contract may be required and in the case of a large or highly technical facility it may be appropriate to consider a separate contract for all or elements of the facility.

5.8 Construction Contract Completion and Acceptance

5.8.1 Facility Systems Tests. During the course of new construction, major repair, or rehabilitation of facilities, it is not unusual to discover installed systems and equipment that contain latent defects due to manufacturing and/or installation practices or do not operate per design. System or equipment defects result in premature failures and increased O&M cost; therefore the inspection of the facility should verify that systems and equipment meet design requirements prior to acceptance of the facility from the contractor and the contractor's departure from the job site. By using available PT&I technologies (see NASA's Reliability Centered Building and Equipment Acceptance Guide combined with thorough baseline and installation/ manufacturer documentation and traditional operational parameters, acceptance testing will reduce premature failures, increase safety and reliability and decrease life-cycle costs. Typical PT&I technologies used during acceptance testing include, but are not limited to, vibration analysis, oil and hydraulic fluid analysis, temperature monitoring, airborne ultrasonics, electrical system testing, and fluid flow and process analysis. Final test results must be documented and provided to the O&M organization for use as baseline data.

5.8.1.1 Subsystem Tests. Subsystem testing is required to identify latent defects and to ensure that parts of the facility systems or standalone subsystems are functioning properly and within specifications prior to a full integrated systems test. Examples may be (1) testing and operating air handling units, chillers, and water pumps prior to integrating their operation with the facilities control system; (2) testing and operating a lubrication oil system for a new wind tunnel drive system; and (3), testing high voltage cable insulation prior to system energizing. Test plans are usually written to provide guidance during testing. A record of test results should be maintained and provided to the O&M organization for future reference. The plans must include the use of Reliability Centered Building and Equipment Acceptance (RCBEA) utilizing PT&I technology as described in NASA's Reliability Centered Building and Equipment Acceptance Guide where applicable. Subsystem test plans can be as simple or complex as required depending on the complexity and interaction of the test parameters.

5.8.1.2 Integrated Systems Test. The integrated systems test (IST) is an end-to-end complete test of a total system. Examples are (1) startup, verification of all operating parameters, and shutdown of a new wind tunnel; (2) testing of a fire detection and protection system for a new facility; and (3), operational testing of a digitally controlled facility air conditioning system. Test plans can be simple to very complex as in the case of a wind tunnel IST. Records of the test results must be maintained and provided to the O&M organization for future reference.

5.8.2 Prefinal Inspection.

5.8.2.1 When the FPM considers the work to be substantially complete, arrangements must be made to inspect the facility in advance of the scheduled final completion date. The FPM, the assigned inspector, the contractor, safety and/or occupational health representative as appropriate (per NPR 8715.3, NASA Safety Manual and NPD 1800.2, NASA Occupational Health Program), and other appropriate personnel shall make the pre-final inspection. The objective of this inspection is to identify defects and deficiencies and schedule the necessary corrective work. In conducting the prefinal inspection, the FPM shall verify that appropriate systems tests have been performed (see paragraph 5.8.1, Facility Systems Tests) and the construction is in accordance with the contract drawings and specifications and should:

a. Identify and highlight those defects that could delay the installation of critical mission equipment, and

b. Identify instances when defects and faulty production would impose undue additional expense.

5.8.2.2 All of the deficiencies identified in this prefinal inspection must be recorded and furnished to the CO and the contractor.

5.8.2.3 The contractor must develop a schedule for the work to correct these deficiencies; and, after approval, shall

provide a copy of the schedule to the FPM. The contractor shall correct these items and with the FPM and the assigned inspector verify their completion. It may be necessary to repeat this effort several times. When the FPM is satisfied that the deficiencies have been corrected, the final inspection can be scheduled.

5.8.3 Final Inspection.

5.8.3.1 The COTR shall establish the date for the final inspection. The FPM shall notify all agencies and organizations that have a need to participate in the final inspection of the facility. The size of the inspection group should be held to the minimum but should include the following:

a. CO,

b. FPM,

c. Project inspector,

d. User organization representative,

e. Safety and/or occupational health representative as appropriate, and fire protection representatives (per NPR 8715.3, NASA Safety Manual),

f. Representative of the Center O&M activity,

g. Contractor's representative, and

h. Other essential representatives.

5.8.3.2 If appropriate, manufacturer's representatives for major equipment items, Center operation and maintenance personnel, and representatives of other activities involved in the future operation of the facility should also be available.

5.8.3.3 The actual inspection tour will follow an established schedule; and, prior to the inspection, each member of the group may be provided with a list of the items that were corrected during prefinal inspections. The final inspection shall generally include the following:

a. A tour of the entire facility project,

b. Verification of corrections of previously identified deficiencies,

c. Inspection of contractor work. Contractor installed equipment should be operating or started and controls made to function,

d. Identification of systems that are to be tested and inspected at a future date because of weather or other conditions, and

e. Identification of construction deficiencies not previously identified.

5.8.4 Acceptance of Facilities.

5.8.4.1 The report of the facility project final inspection shall provide the status of each major system or subsystem which is part of the project. The status shall include a schedule of all future tests and inspection of equipment not inspected due to lack of actual operating conditions. Also included shall be a schedule for the correction of any remaining construction deficiencies. As part of the process of final inspection, the FPM may make arrangements for the user to have access to the facility. This normally constitutes beneficial occupancy of the facility and the FPM shall establish the conditions and schedule under which personnel and organizations may occupy and use the facility.

5.8.4.2 The transfer of a facility project to NASA custody will be completed within 60 days after completion of the final acceptance inspection. The following are part of this process:

a. The O&M organization, in concert with the using activity, should assume the responsibility for the operation and maintenance of the facility and shall provide other than CoF resources for this work, and

b. The FPM shall prepare and forward to the Center real property accountability officer, the following:

(1) For work accomplished by a contractor or NASA personnel, a NASA Form 1046, Transfer and/or Notification of Acceptance of Accountability of Real Property, and

(2) For work accomplished by the Department of Defense, a DOD Form 1354, Transfer and Acceptance of Military Real Property.

5.8.4.3 The type of acceptance (i.e., full or limited) that is used will depend upon the circumstances at the time that NASA assumes custody of the facility. A full discussion of types of acceptance and instructions on the uniform procedures for physical accountability, recording, and reporting of real property is provided in NPR 8800.15A, Real Estate Management Program Implementation Manual.

5.8.5 Record Drawings. If required by the contract, the FPM shall have available from the contractor a set of contract drawings on which all changes have been recorded. These drawings are the basis for development of as-built record drawings for the facility. Record drawings are required for each facility project and can be provided as part of the construction contract or as engineering services by the designer.

5.8.6 Warranties/Guarantees. The CO shall ensure that the warranties and guarantees fully cover all of the conditions stated in the contract documents. The contractor guarantees production equipment or material for the terms specified in the construction document after the Government accepts the facility. The warranties on equipment begin when the equipment is accepted and must clearly state the responsibilities of the manufacturer and installation contractor. In those instances when it is necessary to delay the test and inspection for certain items of equipment, the CO, contractor, FPM, and Center maintenance activity will establish the responsibility for the equipment while awaiting acceptance of the real property accountability for the facility and equipment. The local facility maintenance activity shall establish procedures to ensure that the terms of the warranties and guarantees are exercised if necessary.

5.8.7 Latent Defects. Latent defects may be present. In general, the standard or test for latent defects is the defect must have been present before acceptance of the product by the Government and the defect could not have been discovered through reasonable inspection. Therefore, initial decisions by the FPM, in conjunction with the A-E, if appropriate, regarding the type and nature of acceptance testing and criteria are important. It is also important to keep in mind that excessive inspection is paid for by the Government. Appropriate attention to recordkeeping is essential. Historically, any claim for relief by the Government under the latent defects principle has been contentious and difficult.

5.8.8 Final Contract Closeout.

5.8.8.1 The FPM is responsible to ensure customer satisfaction along with meeting the stated objectives of scope, schedule, and budget.

5.8.8.2 The FPM can continually improve future performance by soliciting feedback from customers via a questionnaire shown in Figure 5-4, Facility Project Management Questionnaire.

5.8.8.3 The CO, assisted by the FPM, shall accomplish final contract closeout. This is done in the following two steps:

a. First, following the closeout of changes and claims, it is necessary to complete SF 1420 Performance Evaluation - Construction Contracts. Past performance records, aside from being a requirement, facilitate evaluation of future bids and is more precise. Thus, adequate project records must be maintained with this purpose in mind as well as for day-to-day management of the project work.

b. Second, the CO shall assemble the final file records and store them pursuant to the FAR and other records management guidance. These two steps shall be accomplished within 90 days of final inspection.

5.8.8.4 To avoid or reduce the potential delay in contract fiscal completion from contractor claims, the CO and the FPM must have adequate records of the contract work. These records should include all proposed and approved contract modifications, status of prior contractor claims, and other materials that can be used to assist in the prompt establishment of the Government position on a contractor's claim. During the performance of the contract work the following action should be taken:

a. Ensure the project inspector's log is complete and accurate and covers all construction activities on the project,

b. Maintain accurate records of modifications to the basic contract that incorporate approved change orders,

c. Record all official communications with the contractor,

d. Receive current as-built construction drawings which cover all the work accomplished under the contract, and

e. Emphasize the followup on the correction of construction defects and deficiencies identified during the prefinal and final inspection.

FACILITY PROJECT MANAGEMENT QUESTIONNAIRE

The Facilities Project Manager requests your participation in our efforts to improve our services by completing this questionnaire.

Project Description: _____	Control Number: _____
Location: _____	Project Manager _____
Date: _____	

For Customer Use	Yes	Nc
Were you involved in every step of the project (i.e., from inception to completion)?		
Did the work performed satisfy your requirements (function, quality, timeliness)?		
Was the project manager readily available and responsive during the course of the project?		
Did the project manager resolve your concerns to your Satisfaction?		

Remarks: _____

Figure 5-4 Facility Project Management Questionnaire

5.8.8.5 When agreement is not reached through normal negotiations, the construction contractor may submit a claim to the CO who has the authority to establish the Government position on the claim. With proper Government records, the evaluation and processing of contractor claims can be expedited and the Government position quickly established. The Government records provide the basis for action on the claim by the CO and, in the event the action is referred to Headquarters, the data are on hand for forwarding with the claim. After the claim is ruled upon, the contractor has 90 days to file a written appeal to the NASA Board of Contract Appeals or 12 months to appeal through a U.S. Claims Court.

CHAPTER 6: Activation

This chapter provides guidance for facility activation, which is the final process prior to beneficial use of a new or renovated facility. The FPM is responsible for the activation process, which includes the following:

a. Facility outfitting,

b. Subsystems and integrated systems tests,

c. Final inspection and acceptance of the outfitted facility,

d. Final cost closeout, and

e. Facility turnover to the Customer and O&M organizations.

Several of these activities involve or may be the principal responsibility of others. For example, subsystem testing is usually the responsibility of the contractor or subcontractor supplying or installing the system. Nonetheless, the FPM is responsible for coordination and completion of these tasks.

6.1 Facility Activation Plan

During the design process an Activation Plan (see paragraph 4.9, Facility Activation Plan, for details of the Activation Plan including its content) should have been prepared and during the construction phase the plan should have been updated and expanded as necessary (see paragraph 4.9.1.2). This plan outlines the steps in the facility activation process with milestones to measure progress. It also identifies the budgets necessary to implement the activation elements (see Appendix C, Forms and Instructions, NASA Form 1510, Facility Project Cost Estimate, for related cost which provides a list of possible elements.)

6.1.1 Schedule. A typical CoF project schedule including activation is shown in Figure 2-4. The Facility Activation Plan (see paragraph 4.9, Facility Activation Plan) contains network bar-type charts depicting a time-phased schedule with milestones for all of the activation activities. This schedule must be revised as more details become available, planning changes, or events occur that effect the schedule in order to provide a working schedule for the activation phase.

6.1.2 Checklist. The following provides a checklist of necessary items (including completion of construction contract items awaiting punch list completion and noncollateral equipment installation) for the activation process:

a. Activation plan,

b. Latest approved 1509,

c. Long form writeup input (budget/scope),

d. Projected O&M cost,

e. Noncollateral equipment installation,

f. Subsystem tests (list each, list test limits where applicable, and the PT&I technology to be used where applicable),

g. Integrated systems test plan,

h. Integrated systems safety review,

i. Integrated systems test,

j. Operational readiness review,

k. Facility systems training (each system),

l. O&M instructions; PT&I, and CMMS information; and manuals,

m. Prefinal inspections,

n. Final inspections,

o. Punch list (close out),

p. Facility and systems as-builts,

q. Warranty transfer,

r. Final facilities construction contract closeout,

s. Contractor performance records,

t. Data systems design,

u. Data systems installation,

v. Systems furniture design,

w. Systems furniture purchase,

x. Systems furniture installation,

y. Telephone installation,

z. Personnel move in, and

aa. Turnover to customer and O&M organization.

6.2 Activation Budget

6.2.1 Budget planning for activation should start early enough in the planning phase of the project to properly indicate the estimated costs associated with all tasks necessary to verify the facility meets the project requirements; systems operate within the design parameters; and the facility and operating organization are ready to use and maintain the facility. The budget planning should have included all costs necessary to outfit the facility for personnel move in and its intended operation (i.e., installation of ground support equipment, integration and checkout of combined facility and noncollateral equipment systems, installation of computer data wiring and systems, installation of systems furniture, and installation of telephone systems). All costs to demonstrate acceptance of an operable facility should be included in the planning.

6.2.2 NASA Form 1509 should indicate the activation costs (described above) associated with the project (see Appendix C, Forms 1509 and 1510). The long form writeup should also include the activation costs and scope.

6.3 Facility Outfitting

Projects or tasks associated with facility outfitting (see Appendix A, Definitions, for "outfitting" definition) are not funded from the CoF appropriation; they should be funded from non-CoF appropriations. The following are when facility outfitting begin:

a. Beneficial or joint occupancy is taken of the facility or a portion of the facility, and

b. The construction of the facility project or a portion of the facility, such as a work package or a specific area, is complete and has been accepted by the Government.

6.3.1 Facility outfitting includes the following (for more detail see Appendix D, Facility and Other Related Costs):

a. Noncollateral equipment installation,

b. Data systems installation,

c. Systems furniture installation,

d. Telephone installation,

e. Furniture and equipment move in,

f. Personnel move in, and

g. Maintenance services startup.

6.4 Completion and Acceptance of Activation Installed Systems

During the activation of a facility noncollateral equipment and systems may be installed to outfit the facility so it may perform its intended function. The equipment and/or systems may contain latent defects due to manufacturing and/or installation practices or do not operate per design either independently or when interfaced with the facility and/or its equipment and/or systems. Defects could not only cause premature failures and increased O&M cost for these items but could also affect the facility systems and equipment or other equipment they interface with causing similar problems. Therefore, inspections of the equipment and systems should be made to verify that they meet design parameters prior to placing the equipment/systems in operation.

6.4.1 Subsystem Tests. Subsystem testing is required to ensure that the noncollateral equipment or standalone subsystems are functioning properly and within specifications prior to placing them in operation or performing a full integrated systems test. Test plans should be written to provide guidance during testing and records of the results should be maintained. The plans must include the use of Reliability Centered Facilities and Equipment Acceptance utilizing PT&I technology as described in NASA's Reliability Centered Building and Equipment Acceptance Guide where applicable. The test plans can be simple or complex depending on the complexity and interaction of the test parameters.

6.4.2 Integrated Systems Test. The integrated systems test is an end-to-end complete test of a total system. This test may be required when equipment has been added to a system during outfitting.

6.4.3 The noncollateral equipment and systems installed during activation are normally the responsibility of the user. The user will operate and maintain the equipment and systems or make arrangements with the Center maintenance organization or an outside contractor to perform these functions.

6.5 Facility Operation and Maintenance (O&M) and Training Considerations

O&M and training can extend beyond the construction stage of a project and into the activation stage. Complex technical projects usually require additional operator training and certification after the construction contractors have completed their responsibility. In addition, operating organizations will typically write a more detailed facility operation and maintenance plan that includes the interfaces and operating procedures with other systems and facilities. These additional requirements should be included in the activation plan and budgets.

6.6 Facility Completion

The objective of the FPM is to provide a completed facility that meets the functional requirement on schedule and within the approved funds. The successful completion of the activation phase completes the facility's project and brings to an end the responsibilities of the FPM. The facility is now the responsibility of the customer and the Center's maintenance and operations organizations.

APPENDIX A: Definitions

Activation - the portion of the total facility acquisition process that normally follows construction. It includes the installation of ground support equipment, the integration and checkout of combined facility and equipment systems, installation of noncollateral equipment, and demonstration and acceptance of an operable facility.

Addition, Expansion, Extension - a physical increase to a real property facility, which adds to the overall dimension of the facility.

Administrator - The person responsible for leading NASA.

Agency - any executive department, agency, commission, authority, administration, board, or other independent establishment in the executive branch of the Government including any corporation wholly or partly owned by the United States and which is an instrumentality of the United States. The term as used herein does not include the municipal Government of the District of Columbia.

Allocation - (1) as used by the Office of Management and Budget and the Department of the Treasury, an amount set aside by an agency in a separate appropriation or fund account for the use by another agency to carry out the purpose of an appropriation. This term applies to amounts set aside in transfer appropriation accounts and allocated working funds; (2) the authoritative assignment of a specific amount of funds or quantity of resources to a specified agency or for a designated use usually for a given period of time; and (3), the portion of joint or indirect cost assigned to a specific objective such as a program, function, project, job, or service.

Allotment - an authorization stated on a NASA Form 504 to incur commitments, obligations, and outlays within a specific amount pursuant to an appropriation or other statutory authority. The allotment constitutes a legal limitation on the total amount of funds stated thereon in accordance with procedures governing the administrative control of appropriations and funds.

Apportionment - a distribution by the Office of Management and Budget of amounts available for obligation and outlay in an appropriation of fund account. The amounts may be available only for specified time periods, activities, functions, projects, objects, purposes, or combinations thereof. The specified amounts limit obligations to be incurred.

Appropriation - statutory authority that allows Federal agencies to incur obligations and make payments out of the Treasury for specific purposes. An appropriation usually follows enactment of authorizing legislation.

a. Annual Appropriation - an appropriation which is available for incurring obligations only during 1 fiscal year specified in the annual appropriation Act,

b. Continuing Appropriation - an appropriation which is available for incurring obligation until exhausted or objectives are achieved,

c. Current Appropriation - an appropriation which is available for obligation during the current fiscal year,

d. Lump&-Sum Appropriation - an appropriation in a specified amount made for a complete program without prescribing limitation of outlays within the stated purpose and amount,

e. Multiple-Year Appropriation - an appropriation which is available for incurring obligations for a definite period in excess of 1 fiscal year (i.e., CoF),

f. No-Year Appropriation - an appropriation which is available for incurring obligations for an indefinite period of time, and

g. 1-Year Appropriation - an appropriation that is available for incurring obligations only during a specified year.

Appropriation Year - the fiscal year in which obligations were authorized to be incurred for an annual appropriation.

Approved Facility Project Cost Estimate - the AFPCE, as listed on the 1509 and supported by the 1510, is the

maximum that can be expended on a particular project or portion thereof. The original authority must approve any increase.

At-Risk Project - a project for which one of the following applies:

a. Final design has not started by the end of May preceding the fiscal year in which the project is proposed for congressional authorization, or not completed by February of the fiscal year in which the project was authorized and appropriated,

b. Significant requirements changes are made that alter the project scope as presented to Congress,

c. Construction award has not been made or is not scheduled to occur by June of the fiscal year in which the project was authorized and appropriated, and

d. Category C projects that are not awarded within 6 months after the date of release of the construction funds.

When a project is designated at risk, it can lose its funding allocation. The resources allocated to an at risk project can then be made available for satisfying shortages in Congressional appropriations or be used to fund projects at locations where resources will be obligated in a timely manner.

Authorization - a separate Act that authorizes appropriations to be made for specific purposes.

Beneficial Occupancy Date - the date on which a facility or that portion of a facility for which beneficial occupancy applies, is made available to NASA for use.

Bid Opening Date - the date all sealed bids must have been received by the Government and all bids are opened and recorded for an Invitation for BID.

Brief Project Document - NASA Form 1509 is a multipurpose document that is used from inception to completion of all facility projects estimated to cost $50,000 or more.

Budget - a formal estimate of future revenues, obligations to be incurred, and outlays to be made during a definite period of time; and, when determined to be appropriate, based on accrued expenditures and costs to be incurred.

Budget Cycle - the period of time which elapses from the initiation of the budget process to the completion of the budget process for a particular fiscal year.

Budget Estimate - an estimated fund requirement for any element included in a budget. Collectively, all estimated fund requirements for a particular operating agency or component or consolidation thereof.

Budget Guidelines - both general and specific instructions furnished by a higher level of management as a basis for budget formulation and execution.

Budget Process - the process embracing all the stages through which the budget passes including the formulation stage, the review and enactment stage, and the execution stage.

Budget Year &- the fiscal year for which estimates are submitted which is the period including October 1 through the following September 30 (see Fiscal Year).

Category A - is used for minor projects to indicate the requirement for the project was included in a congressionally budget submission.

Category C - is used for minor projects to indicate the requirement for the project has not been recognized in any congressional budget submission

Centers - Primary NASA field entities, each led by a Center Director. Some Centers have component facilities, which may be geographically separated from the parent Center. Such facilities are led by a Manager or Head who reports to the parent Center official. The following are Centers:

a. Ames Research Center (ARC),

b. Dryden Flight Research Center (DFRC),

c. John H. Glenn Research Center (GRC) at Lewis Field,

d. Goddard Space Flight Center (GSFC),

e.. Lyndon B. Johnson Space Center (JSC),

f. John F. Kennedy Space Center (KSC),

g. Langley Research Center (LaRC),

h. George C. Marshall Space Flight Center (MSFC), and

i. John C. Stennis Space Center (SSC).

Change in Scope - a change in objectives, work plans, or schedules which result in a material difference from the terms of an approval to proceed previously granted by higher authority; and, under certain conditions (normally stated in the approval instrument), changes in resources application may constitute a change in scope.

Change Order - a written order, signed by the contracting officer, directing the contractor to make changes to the project with/without the consent of the contractor where appropriate.

Chief Financial Officer/Comptroller - the official-in-charge of all fiscal and financial plans and operations.

Collateral Equipment (also see Noncollateral Equipment) - building-type equipment, built in equipment, and large substantially affixed equipment/property; and, is normally acquired and installed as a part of a facility project and includes as follows:

a. Building-Type Equipment - equipment that is normally required to make a facility useful and operable. It is built-in or affixed to the facility in such a manner that removal would impair the usefulness, safety, or environment of the facility. Such equipment includes elevators; heating, ventilating, and air-conditioning systems; transformers; and compressors and other like items generally accepted as being an inherent part of a building or structure and essential to its utility. It also includes general building systems and subsystems such as electrical, plumbing, pneumatic, fire protection, and control and monitoring systems.

b. Built-In or Large Substantially Affixed Equipment/Property - the unit of equipment or property of any type other than building type equipment which is built in, affixed to, or installed in real property in such a manner that the installation cost including special foundations or unique utility services, or facility restoration work required after its removal, exceeds $100,000.

Completion Date - the date on which the Government formally accepts an item of work from a contractor. The date on which the Government accepts all contract deliverables is the contract completion date.

Component Facilities - organizations that are geographically separated from the NASA Centers to which they are assigned (see Centers). NASA Centers with their component facilities annotated are as follows:

a. Deep Space Network - Goldstone, CA; Canberra, Aus.; Madrid, Spain; (JSC),

b. Downey Facility (DF) (JSC),

c. Ground Network at KSC (GSFC),

d. Independent Verification and Validation Facility (IV&V) (GSFC),

e. Michoud Assembly Facility (MAF) (MSFC),

f. NASA Management Office (NMO)/JPL (HQ/Code S),

g. Palmdale (JSC),

h. Plum Brook Station (PBS) (GRC),

i. Santa Susana Field Laboratory (MSFC),

h. Space Network (White Sands, NM) (GSFC),

i. Wallops Flight Facility (Wallops Island, VA) (GSFC), and

j. White Sands Test Facility (WSTF) (JSC).

Comptroller- see Chief Financial Officer.

Computerized Maintenance Management System (CMMS) - a set of computer software modules and equipment databases containing facility data with the capability to process the data for facilities maintenance management

functions. They provide historical data, report writing capabilities, job analysis, and more. The data describe equipment, parts, jobs, crafts, costs, step-by-step instructions, and other information involved in the maintenance effort. This information may be stored, viewed, analyzed, reproduced and updated with just a few keystrokes. The maintenance-related functions typically include -

a. Facility/Equipment Inventory,

b. Facility/Equipment History,

c. Work Input Control,

d. Job Estimating,

e. Work Scheduling and Tracking,

f. Preventive and Predictive Maintenance,

g. Facility Inspection and Assessment,

h. Material Management, and

i. Utilities Management.

Constructability - the design and installation properties and characteristics of a facility that enable it to be constructed in a cost effective and timely manner.

Construction - alteration or repair (including dredging, excavating, and painting) of buildings, structures, or other real property. For purposes of this definition, the terms buildings, structures, or other real property include but are not limited to improvements of all types such as bridges, dams, plants, highways, parkways, streets, subways, tunnels, sewers, mains, power lines, cemeteries, pumping stations, railways, airport facilities, terminals, docks, piers, wharfs, ways, light-houses, buoys, jetties, breakwaters, levees, canals, and channels. Construction does not include the manufacture, production furnishing, construction, alteration, repair, processing or assembling of vessels, aircraft, and other kinds of personal property.

Construction Contractor - a business entity (i.e., person, corporation, partnership, joint venture) which has satisfied the contracting officer that they qualify as one: (1) who owns, operates, or maintains a place of business regularly engaged in the construction, alteration, or repair of buildings, structures, communication facilities, or other engineering projects including furnishing and installing of the necessary equipment; or (2) who, if currently entering into a construction activity, has made all necessary prior arrangements for personnel, construction equipment, and required licenses to perform construction work.

Construction of Facilities - a congressional appropriation which provides funding for the revitalization projects (repair, rehabilitation, and modification of existing facilities); the construction of new facilities; the acquisition of related collateral equipment; environmental compliance and restoration activities; the design of facilities projects; and advanced planning related to future facility needs.

Contingency (Construction) - an allowance included in the current cost estimate to cover uncertainties during the construction phase of the project such as site conditions and construction interferences (see also Contingency (Design)).

Contingency (Design) &- an allowance included in the engineering estimate to allow for added unanticipated costs due to design uncertainties and incomplete or changing user requirements.

Contracts - all types of agreements and orders for the procurement of supplies or services. Includes awards and notices of award; contracts of a fixed-price, cost, cost-plus a fixed-fee, or incentive type; contracts providing for the issuance of job orders, task orders, or task letters; letter contracts; and purchase orders. It also includes supplemental agreements with respect to any of the above.

Contract Award - the date the contracting officer signs the contract documents.

Contract Modification - any written alteration in the specification, delivery point, rate of delivery, contract period, price, quantity, or other contract provisions of an existing contract whether accomplished by unilateral action in accordance with a contract provision or by mutual action of the parties to the contract. It includes bilateral actions such as supplemental agreements; and, unilateral actions such as change orders, administrative changes, notices of termination, and notices of the exercise of a contract option.

Contracting Officer - any person who, by appointment in accordance with procedures prescribed by the Federal

Acquisition Regulations (FAR) and NASA FAR Supplement, has the authority to enter into, administer and/or terminate contracts, and make related determinations and findings. The term includes certain authorized representatives of the contracting officer acting within the limits of their authority as delegated by the contracting officer.

Contracting Officer Technical Representative - an authorized representative of the contracting officer acting within the authority delegated by the contracting officer.

Contractor - the supplier business entity providing an end item of supply or serving under the terms of a specific contract.

Current Cost Estimate - a calculated anticipated amount that reflects the latest and best professional cost estimate for a given project at any given time during planning, design, or construction. It is the amount that is anticipated that will be expended for labor, materials, and other items and contractor services required to fully execute the planned facility project. It includes all amounts anticipated to be expended for land acquisition; site work; construction; and the purchase and/or installation of building-type and built in equipment or furnishings as well as large substantially affixed equipment. It must include a reasonable estimate for contingencies. If the project is to be carried out for NASA by a construction agent, the estimated cost also includes costs associated with the use of such an agent.

Current Year - the fiscal year immediately preceding the budget year.

Design - the term used to encompass both preliminary design and final design for facility projects. Design costs are normally funded under the CoF appropriation. Design costs of facility projects proposed for funding under appropriations other than CoF are normally funded under the same appropriation from which the facility project is to be funded with such costs being identified separately from the facility project cost estimate.

Design Reviews - a technical review comment and approval of the facility project engineering design work generally conducted at the 35 percent, 60-percent, and 90-percent design milestones of the project.

Directors of Centers - the heads of the Centers.

Discrete Facility Program - construction and facility revitalization (repair, rehabilitation, and modification) in excess of $1,500,000; and land acquisition and emergency repair approved under the provisions of Section 308(b) of the National Aeronautics and Space Act of 1958, as amended, at any cost.

Disbursements - gross disbursements represent the amount of checks issued and cash or other payments made less refunds received. Net disbursements represent gross disbursements less income collected and credited to the appropriation or fund account such as amounts received for goods and services provided.

Drawings - graphic data including drawings as defined in MIL-D-STD-100A and prepared in accordance with MIL-D-1000, Category D; aperture cards in accordance with MIL-C-9877; graphs or diagrams, industry standards, and industry specifications on which details are represented with sufficient information to define completely, directly or by reference, the end result in the selection, procurement, and manufacture of the item required.

Easement - an acquired privilege or right of use or enjoyment that one may have in land of another. For example, an easement for road or highway purposes, construction, and maintenance of utility lines.

Emergency Repair - restoration of an existing facility or the components thereof when such facilities or components have been made inoperative by major breakdown, accident, or other circumstances that could not be anticipated in normal operations; and, the repair is of such urgency that it cannot await programming and accomplishment in the normal budget cycle. In the process of emergency repairs, the replacement of components or materials will be of the size or character currently required to meet firm demands or needs.

Environmental Analysis - the process that makes the initial evaluation of the environmental effects of a proposed action including alternative proposals.

Environmental Assessment - a document within which the environmental effects of proposed actions are initially identified and analyzed. It forms the basis for a Finding of No Significant Impact or a Notice of Intent to Prepare an EIS.

Environmental Impact Statement - a device for use by officials to plan actions and make decisions. It documents the environmental analyses of major actions that have a significant impact upon the quality of the environment.

Equipment/Property - all types of equipment including collateral equipment, general purpose equipment, special test equipment, ground support equipment, and other special purpose equipment such as automatic data processing equipment, data control consoles, and instrumentation which may or may not be capitalized.

Facility - land, buildings, structures, and other real property improvements including utility systems and collateral equipment. The term does not include operating materials, supplies, special tooling, special test equipment, and noncapitalized equipment (see Financial Management Manual for criteria for capitalized equipment). The term facility is used in connection with land, buildings (facilities having the basic function to enclose usable space), structures (facilities having the basic function of a research or operational activity), and other real property improvements.

Facility Acquisitions - the acquisition of an interest in land, buildings, other structures and facilities, or leasehold improvements. The normal facility acquisition methods include purchase, transfer, lease, easement, use permit, and rights of way.

Facility Activation - the process of bringing a newly defined capability on-line following the completion of the basic previously defined Construction of Facilities project. This includes, but is not limited to, such activities as installation of noncollateral equipment; connection of noncollateral equipment to its interface; checkout of systems; and validation activities in support of operational readiness testing.

Projects or tasks associated with normal facility activation for noncollateral items or capabilities are not properly CoF funded but should be funded by either program or institutional resources as appropriate; and be properly documented and approved as may be required through normal management channels. The activation process begins when:

a. The construction of a facility project or a definable portion such as a work package or specific area is complete and has been accepted by the Government; or,

b. Beneficial or joint occupancy is taken on a facility project or definable portion thereof.

Facilities Maintenance - the recurring day-to-day work required to preserve facilities (buildings, structures, grounds, utility systems, and collateral equipment) in such a condition that they may be used for their designated purpose over an intended service life. It includes the cost of labor, materials, and parts.

Maintenance minimizes or corrects wear and tear and, thereby, forestalls major repairs. (Facilities maintenance work does not include work on noncollateral equipment.)

Facility Need Date - the date when the appropriate facility is required to receive program hardware for test and checkout. First operational use of the facility completes this milestone.

Facility Outfitting - see outfitting.

Facility Project - the consolidation of applicable specific individual types of facility work including related collateral equipment, which is required to reflect all of the needs. Generally, they are related to one facility, which have been or may be generated by the same set of events or circumstances, which are required to be accomplished at one time in order to provide for the planned initial operational use of the facility or a discrete portion thereof.

Facility Project-Brief Project Document (Form 1509) - a multipurpose document which must be used for all facility projects estimated to cost $50,000 or more regardless of location or source of funding.

Facility Project Cost Estimate (Form 1510)- data for the approved facility project cost estimate (AFPCE) summarized in NASA Form 1509.

Facility Project Management System -; the computerized system used to generate monthly status reports on the Construction of Facilities program. (see FPMS for details of the current system).

Facility Project Manager - an individual who has the most direct responsibility to organize, manage, and direct the multitude of activities and complete the assigned facility project work on schedule with the approved funds. Different individuals may fill this role at different phases of a project. Titles used at the different Centers may also vary for this position.

Failure Modes and Effects Analysis (FMEA) - analysis used to determine what parts fail, why they usually fail, and what effect their failure has on the systems in total. An element of Reliability Centered Maintenance (RCM). (see Reliability Centered Maintenance Guide for Facilities and Collateral Equipment for details.)

Federal Agency - any executive agency or any establishment in the legislative or judicial branch of the Government (except the Senate, the House of Representatives, the Architect of the Capitol, and any activities under the architect's direction).

Fiscal Year - the Federal Government's 12-month period from October 1 on one calendar year through September 30 of the following year.

5-Year Plan - projects that meet functional requirements needed to achieve a Center's assigned mission objectives and the conversion of these requirements into facility and equipment resource needs.

Flash Bid Report (Form 1579) - a form summarizing the results of a project bidding process.

Forecast - predicted costs or accomplishments of a plan based on projected future conditions. The term is used in connection with projecting estimated commitments, obligations, and outlays for a period of time in the future.

Fragmentation - separation of distinct facility requirements into increments that are dependent on each other to provide a complete and usable facility. In order to prevent the appearance of fragmentation, additional work may not be added until 90 days after completion of the project without approval of the Headquarters Director, Facilities Engineering Division.

Full Disclosure Concept - for all stages of planning, approval, and management of a facility project, the Full Disclosure Concept requires that the project documentation outline all reasonably identifiable elements of cost necessary to achieve a fully operable facility for initial occupancy together with an appropriate allowance for contingencies that may arise during construction. This documentation will identify those elements normally included in the estimated cost of the facility project including applicable collateral equipment; and, it will identify by source, general types, and cost all other equipment required so that the facility may serve its initial function or purpose (see Appendix D, Facility and Other Related Costs, for a listing of items and types to include). The project documentation must also identify and quantify those elements of cost, which are otherwise appropriate for inclusion in the project cost or supporting documentation; but for which meaningful cost estimates cannot be prepared at that time. This effort is necessary in order to assess the total project cost impacts and to permit the authorizing or approving authority to recognize which elements of cost are not included at any given time and which elements may subsequently require additional funding from the same or a different source.

Functional Management - the centralized professional leadership, coordination, and oversight policy guidance of Agencywide activities in a given technical or administrative functional area to ensure effective and efficient performance.

Fund - a sum of money or other resource authorized by law to be set aside and to be used or expended only for specified purposes.

Funding - the issuance of allotments (NASA Form 504) which provide authority to incur commitments and obligations and make payments within appropriations made by Congress, apportionment limitations established by the Office of Management and Budget (OMB), and the approved resources authorization (NASA Form 506A).

Government Furnished Property - property owned by the Government and provided to a contractor for use in performance of a contract.

Ground Support Equipment - non-flight equipment, implements, and devices required for the handling, servicing, inspecting, testing, maintaining, aligning, adjusting, checking, repairing, and overhauling of an operational end item or a subsystem or component thereof. This may include equipment required to support another item of ground support equipment as defined herein.

Improvements - an addition to land, buildings, other structures, and attachments or annexations to land that are intended to remain so attached or annexed such as sidewalks, drives, tunnels, utilities, and installed collateral equipment.

Indirect Cost - cost of labor and material that cannot be related to specific research and development projects.

Installation - NASA Headquarters, Centers and component facilities.

Invitation for Bids - the complete approved solicitation documents used to acquire a project requirement under sealed bidding rules in the Federal Acquisition Regulations and NASA FAR Supplement.

Jet Propulsion Laboratory (JPL) - Government-Owned, Contractor-Operated (GOCO) facility, is a Federally Funded Research and Development Center (FFRDC), under the terms of a contract with the California Institute of Technology (CalTech).

Land Acquisition - acquisition of title to land including any interest therein such as mineral and water rights, easements, rights of way, or interagency permits whether obtained by purchase or other means.

Lease - an instrument conveying an interest in land, buildings, or other structures and facilities for a specified term; and, revocable as specified by the terms of the instrument, in consideration of payment of a rental fee.

Life-Cycle cost - a procedure for determining the long term economic impact of a decision that encompasses all program costs associated with a facility including costs of planning, design, construction, operation, maintenance, salvage, or residual value at the end of the intended period of use.

Limitation - a statutory or administratively imposed restriction within an appropriation or other authorization or fund that establishes the maximum amount that may be used for specified purposes.

Long-Lead-Time Items - items which, because of their complexity of design, complicated manufacturing processes, or limited production may cause production or procurement cycles; and, which would preclude timely or adequate delivery, if not ordered in advance of normal provisioning.

Maintainability - the design, installation, and operational characteristics of an item that enables it to be retained in or returned to a specified operational condition by expending resources at an acceptable rate using prescribed procedures.

Maintenance - see Facilities Maintenance.

Major Facility Work - see Discrete Facility Program.

Management Plan - a formal or informal document that provides direction and guidance for the in-house management of projects. The plan should identify the impact on the Center, risk involved with the project, team members, financial management plans, outage requirements, and the structure/strategy for implementing the project.

Minor Construction - the erection, installation, or assembly of a new or replacement facility; or, an addition in area, volume, or both, to an existing facility. Both are greater than $500,000 but no more than $1,500,000.

Minor Facility Program - construction and facility revitalization (repair, rehabilitation, and modification) in excess of $500,000 and not exceeding $1,500,000.

Mission - the performance of a coherent set of research and development, technology and science investigations or operations to achieve program goals.

Modification - see Rehabilitation and Modification.

Must - Imposes obligation, indicates a necessity to act.

NASA - the National Aeronautics and Space Administration.

NASA installations - Headquarters and all Centers and their component facilities.

Negotiate, Negotiated, and Negotiation - the method of making purchases and contracts without using sealed bidding procedures.

New Capability - a discrete facility project that is required to support new programmatic or institutional requirements. This includes projects for the rehabilitation/modernization and repair of existing facilities when the facility is to be used to support new programmatic or institutional requirements.

Nonappropriated Funds - funds not associated with an appropriation such as funds received through international cooperation, gifts, donations, and NASA exchanges.

Noncollateral Equipment - equipment other than collateral equipment which, when acquired and used in a facility or a test apparatus, can be severed and removed after erection or installation without substantial loss of value or damage to the premises where installed.

A unit of equipment may be considered noncollateral if it has such a close relationship to a Program project hardware item (i.e., prototype or test article, launch vehicle, spacecraft) that it is essentially an extension of the Program hardware item in that its configuration and/or operating characteristics must constantly reflect unpredictable changes in the Program item.

The relationship between the equipment item under consideration and the Program item must be clear and significant; and, it must be evident that sufficiently frequent changes in the equipment item are definitely to be expected due to the nature or complexity of the Program item although it may not be possible to predict the extent or actual frequency of such changes. This definition is provided to permit a more proper classification of equipment involved in the sensitive interfaces frequently found between an item of Program hardware and an associated facility such as a test or a launch stand, wind tunnel, or other Program technical facility. Each case, which involves substantially affixed equipment, will be specifically identified in the appropriate facility project documentation; and, the rationale will be provided to support the determination that the equipment being categorized as noncollateral is so categorized in accordance with

the application of this specific guidance.

Notice to Proceed - the effective date of direction from the contracting officer to the selected contractor authorizing commencement of work.

Obligation - an obligation is incurred when an order is placed, a contract awarded, a service received, or other similar transactions occurred requiring disbursement of money. Obligations are the sum of undelivered orders, liabilities, and disbursements.

Operational Readiness Review - the final NASA review of a facility immediately prior to placement into its intended operation.

Operations and Maintenance Manuals - O&M manuals are organized procedural information specifying methods of operating and maintaining building systems, collateral equipment, and support equipment. O&M manuals are used in the performance of day-to-day operations and maintenance tasks. Preferably the manuals are in an electronic format.

Outfitting - the process of equipping a facility for its intended purpose with items that can be typically replaced or reconfigured many times over the life of the facility.

Option - a unilateral right in a contract by which, for a specified time, the Government may elect to purchase additional supplies or services called for by the contract, or may elect to extend the term of the contract.

Outlays - see Disbursements .

Partnering - a Government-contractor relationship to foster the achievement of mutually beneficial goals (see NFS, 48 CFR Chapter 18 Part 1836 Subpart 1836.70).

Past-Year - the fiscal year immediately preceding the current fiscal year.

Payback - the amortization period defined in years calculated by dividing the total budget estimate by the total expected discounted annual savings.

Predictive Testing & Inspection (PT&I) - the use of advanced technology to assess machinery condition. The PT&I data obtained allows for planning and scheduling preventive maintenance or repairs in advance of failure.

Procurement - the purchasing, renting, leasing, or other acquisition of supplies or services. It also includes all functions that pertain to the acquisition of supplies and services including description but not determination of requirements, selection, and solicitation of sources, preparation and award of contract, and all phases of contract administration.

Program - a related series of undertakings that continue over a period of time (normally years) and are designed to accomplish a broad scientific or technical goal in the NASA Long Range Plan.

Program Offices - Headquarters organizational elements such as:

a. Office of Space Flight (OSF) (Code M),

b. Office of Aerospace Technology (OAT) (Code R),

c. Office of Space Science (OSS) (Code S),

d. Office of Biological and Physical Research (Code U).

e. Office of Earth Science (OES) (Code Y).

Program Operating Plan (POP) - a document produced by a Center in response to Headquarters-directed budget guidelines. It is a compilation of the requested budgets by program or project that are needed to execute the Headquarters direction. In cases where estimate exceeds the guideline, the additional funding requirement is displayed as an over guideline request.

Program Year - a concept of accounting for funds, obligations, and outlays under a no-year appropriation by identification of transactions in fiscal year segments identified by the fiscal year in which individual items were obligated.

Programming - the process of planning and organizing a program; especially, in terms of quantitative physical requirements of human resources, materials, and facilities.

Progress Payment - a payment made to a contractor as work progresses. Amounts usually are based upon costs incurred

and work performed at a particular stage of completion.

Project - within a program, an undertaking with a scheduled beginning and ending which normally involves one of the following primary purposes: (1) the design, development, and demonstration of major advanced hardware items; (2) the design, construction, and operation of a new launch vehicle (and associated ground support) during its research and development phase; and (3), the construction and operation of one or more aeronautical or space vehicles and necessary ground support in order to accomplish a scientific or technical objective.

Project Advocate - the facility user at the Center who also stipulates the functional requirements. The project advocate at Headquarters is the Program Office counterpart of the facility user.

Project Approval Document - a document which, when signed by the Administrator or designee, authorizes and directs the responsible designated official(s) to initiate and carry out the project within the scope defined in the document; and within funding approvals established through the NASA system for resources authorizations and allotment of funds. For CoF, project approval delegations are contained in NPD 7330.1 (for hyperlink see paragraph 2.5.2), Approval Authorities for Facility Projects. The Facility Project - Brief Project Document (NASA Form 1509) constitutes the CoF Program Approval Document (PAD) and is used to approve all construction projects $50,000 or more regardless of source of funding. For facility planning and design (FP&D) activities related to future facility needs, approval is authorized by the Headquarters Director, Facilities Engineering Division, using a specific PAD other than the NASA Form 1509. Use of NASA funds is limited to approved projects but project approval by itself does not provide resources authority.

Project Proposal - a brief summary and description of a proposed project, which is submitted with a draft project approval document to the Deputy Administrator or designee by a program director when requesting authorization to initiate a new project. The project proposal serves as a briefing document on the project as proposed to the Administrator.

Project Scope - the documented broad definition of a facility project expressed in terms of the programmatic or institutional purpose to be served or by the operational capacity or output to be provided by the resultant facility. The expression of the scope of a facility project involves such factors as location; basic purpose or purposes to be served; capabilities, capacity, or output to be provided for such activities as research, test, storage, or other functional needs; collateral equipment needed for the initial use of the projects; numbers and types of personnel to be accommodated; physical dimensions or configuration (structures only); and, area or cubic size of the proposed facility.

Purchase Request/Purchase Order - the funded procurement request document prepared and approved according to the Center instructions that state and describe the Government need for supplies or services.

Real Property - land, buildings, structures, utility systems, and improvements and appurtenances thereto, permanently annexed to land. The term real property also includes installed collateral equipment.

Refurbish - see Rehabilitation and Modification.

Rehabilitation and Modification - the facility work required to restore and enhance and alter or adjust a facility or component thereof, including collateral equipment, to such a condition that it may be more effectively used for its presently designated purpose or so as to increase its functional capability. For simplification in facility project titles, work maybe properly identified as rehabilitation provided the primary reason for accomplishment is that the basic restoration work must be done in any event. It is deemed prudent to accomplish any related enhancement, alteration, or adjustment work at the same time. If the pressing requirement is for the alteration and adjustment work to achieve an increase in functional capability, then the project may be simply classified as modification even though restoration is also involved.

Related Costs - elements of project work that are not included in the facility project cost estimate.

Reliability Centered Building and Equipment Acceptance Guide- a technical reference for design engineers, project and program managers, construction managers and inspectors, quality control personnel, and NASA quality assurance staff to use prior to and during the equipment startup/checkout phase of new construction, repair or rehabilitation projects. It focuses on the use of Predictive Testing and Inspection (PT&I) technologies by the contractor to detect latent manufacturing and installation defects as a normal part of the contractor's quality control program.

Reliability Centered Maintenance (RCM) - the process that is used to determine the most effective approach to maintenance. It involves identifying actions that, when taken, will reduce the probability of failure and which are the most cost effective. It seeks the optimal mix of Condition-Based Actions, other Time- or Cycle-Based actions, or a Run-to-Failure approach. (see Reliability Centered Maintenance Guide for Facilities and Collateral Equipment and PT&I.)

Renewal Rate (Yearly) - expressed in years, it is the Current Replacement Value (CRV) in dollars divided by the Revitalization investment expressed in dollars per year.

Renovate - see Repair.

Repair - that facility work required to restore a facility or component thereof, including collateral equipment, to a condition substantially equivalent to its originally intended and designed capacity, efficiency, or capability. It includes the substantially equivalent replacement of utility systems and collateral equipment necessitated by incipient or actual breakdown.

Replace - see Repair.

Reprogramming - the process of revising a previously established program or project; and revision of budget estimates under a revised program or project.

Request for Proposal - the complete approved solicitation documents used to acquire a project requirement under the negotiating rules in the Federal Acquisition Regulations (FAR) and NASA FAR Supplement (NFS).

Resources - the actual assets of a governmental unit such as cash, human resources, and materials.

Resources Authority Warrant - a document (NASA Form 506A) granting authority to initiate, commit, obligate, and outlay within funds available in the allotment (NASA Form 504) for conduct of approved projects and activities.

Restoration/Modernization - a discrete facility project that restores or modernizes an existing facility currently supporting active and ongoing programmatic or institutional requirements. This includes demolition and replacement with a new facility that has substantially comparable capability and size. This also includes projects that restore, modernize, or upgrade institutional infrastructure capabilities.

Revitalization - is substantial renewal and upgrade work on the physical plant to meet current and future needs, thereby extending its useful life. It is the renewal effort accomplished as a facility project that extends the useful service life beyond the original design life. Includes CoF Restoration and Modernization discrete projects (Repair and Rehabilitation/Modification greater than $1.5M) and CoF Minor Program (Repair and Rehabilitation/Modification greater than $500K but not exceeding $1.5M)

Routine Facility Work - construction, repair, rehabilitation and modification, and environmental projects not to exceed $500,000.

Salvage - property which has some value in excess of its basic material content but which is in such a condition that it has no reasonable prospect of use for any purpose as a unit and its repair or rehabilitation for use as a unit is clearly impracticable.

Shall - Imposes obligation to act, secondary meaning, prediction of future action.

Should - Implies obligation or preference, but not absolute necessity.

Site Activation Need Date - the date equipment/Ground Support Equipment is required to support installation and validation. Uncrating, inspecting, and handling time must be allowed in establishing the site activation need date.

Spare - an item peculiar to a system or end item held in reserve or back-up.

Specifications- Kept- Intact - the NASA standard construction specification system.

Statutory Limitation - see Limitation.

Minor Facility Projects Summary Brief Project Document, Form 800/01 - a document signed by the Headquarters Director, Facilities Engineering Division, used for execution of the Minor Program and Environmental Compliance and Restoration projects. It lists the Approved Facility Project Cost Estimate and approval date by project, provides stipulations for project implementation, and contains the Approved Program Plan that is the Resources Authority (NASA Form 506A) available to complete the projects listed under each category.

Supervision, Inspection, and Engineering Services (SIES) - funding allowance used to provide the necessary controls and management during construction, and such deliverables as as-built drawings and O&M manuals.

Supplemental Agreement - a bilateral modification to a contract that is commonly used to make negotiated equitable adjustments resulting from a change order; definitize letter contracts; and, reflect other agreements of the parties modifying the terms of the contracts.

Sustainability - An overarching concept incorporating appropriate sustainable design practices, maintainable design elements, building commissioning processes, and safety and security features into facility planning, design, construction, activation, operation and maintenance, and decommissioning to enhance and balance facility life-cycle cost, environmental impact, and occupant health, safety, security, and productivity. Done properly, sustainability will optimize the facility acquisition process to ensure the "best fit" of the built environment to the natural environment. It requires a practical and balanced approach to responsible stewardship of our natural, human and financial resources.

Validation - verification that the equipment/system meets the operational needs of the O&M user and is part of the turnover process from the design agency to the O&M agency.

Value Engineering - the systematic application of recognized techniques to determine the lowest practical overall cost of a facility consistent with the requirements of performance, reliability, and maintainability.

Will - Predicts future action.

APPENDIX B: Abbreviations and Acronyms

A.	
ADA	Americans with Disabilities Act
A-E	Architect-Engineer
AFPCE	Approved Facility Project Cost Estimate
ARC	Ames Research Center
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
ASTM	American Society for Testing Materials
B.	
BCA	Building Commissioning Association
BEES	Building for Environmental and Economic Sustainability
BIPV	Building-Integrated Photovoltaics
BMP	Best Management Practices
BTU	British Thermal Units
BY	Budget Year
C.	
CA	Commissioning Authority
CCB	Change Control Board
CCE	Current Cost Estimate
CFO	Chief Financial Officer
CFR	Code of Federal Regulations
CII	Construction Industry Institute
CMMS	Computerized Maintenance Management System
CO	Change Order or Contracting Officer
CoF	Construction of Facilities
COSS	Center Operations Support Services
COTR	Contracting Officer Technical Representative
CPG	Comprehensive Procurement Guidelines
CPM	Critical Path Method
CSI	Construction Specification Institute
D.	
DF	Downey Facility
DOD	Department of Defense

DOE	Department of Energy
DSN	Deep Space Network
E.	
EA	Environmental Assessment
EE	Engineering Estimate
EEO	Equal Employment Opportunity
EIS	Environmental Impact Statement
EMCS	Energy Management Control Systems
EO	Executive Order
EPA	Environmental Protection Agency
F.	
FAR	Federal Acquisition Regulations
FEMP	Federal Energy Management Program
FMEA	Failure Modes and Effects Analysis
FMM	Financial Management Manual
FMP	Facilities Master Plan
FMS	Facilities Management System
FO	Functional Offices
FONSI	Finding Of No Significant Impact
FP&D	Facility Planning and Design
FPDS	Facility Project Data System
FPIG	Facility Project Implementation Guide
FPM	Facility Project Manager
FPMS	Facility Project Management System
FPN	Facility Project Number
FPT	Functional Performance Test
FPT	Functional Performance Tests
FRB	Facilities Review Board
FSC	Federal Supply Catalog
FY	Fiscal Year
G.	
GBA	Green Building Advisor
GFP	Government Furnished Property
GPE	Goverment Furnished Property
GRC	Glenn Research Center
GSA	General Services Administration
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
H.	
HSF	Human Space Flight

HVAC	Heating, Ventilation, and Air-Conditioning
I.	
IAQ	Indoor Air Quality
IEQ	Indoor Environmental Quality
IESNA	Illuminating Engineering Society of North America
IFB	Invitation for Bid
IPO	Institutional Program Offices
ISC	Interagency Security Committee
IST	Integrated Systems Test
J.	
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
K.	
KSC	Kennedy Space Center
L.	
LaRC	Langley Research Center
LEED	Leadership in Energy and Environmental Design
LLIS	Lessons Learned Information System
LOGO	Limitation of Government Obligation
LS	Lump Sum
M.	
MAF	Michoud Assembly Facility
MS	Mission Support
MSFC	Marshall Space Flight Center
N.	
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NEHRP	National Earthquake Hazard Reduction Program
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NFS	NASA Far Supplement
NIBS	National Institute of Building Services
NIST	National Institute of Standards and Technology
NODIS	NASA Online Directives Information Systems
NPD	NASA Policy Directive
NPG	NASA Procedures and Guidelines
NRC	National Research Council
NSBF	National Scientific Balloon Facility
NSPE	National Society of Professional Engineers
NSS	NASA Safety Standard

NTP	Notice to Proceed
O.	
O&M	Operations and Maintenance
OMB	Office of Management and Budget
OPR	Owner's Project Requirements
OSHA	Occupational Safety and Health Administration
P.	
P3	Preproject Planning
PAR	Preadvertisement Review
PBS	Plum Brook Station
PCSD	President's Council on Sustainable Development
PD	Program Direct
PDRI	Project Definition Rating Index
PER	Preliminary Engineering Report
PES	Preliminary Environmental Survey
POP	Program Operating Plan
PR	Procurement Request
PT&I	Predictive Testing & Inspection
Q.	
QA	Quality Assurance
R.	
R&D	Research and Development
RCB&E	Reliability Centered Building and Equipment
RCBEA	Reliability Centered Building and Equipment Acceptance
RCM	Reliability Centered Maintenance
RCRA	Resource Conservation and Recovery Act
REV	Review
RF	Radio Frequency
RFP	Request For Proposal
RFQ	Request For Quote
ROD	Record of Decision
S.	
SAT	Science, Aeronautics, and Technology
SBIC	Sustainable Buildings Industry Council
SF	Subcontractor Furnished or Standard Form
SIES	Supervision, Inspection, and Engineering Services
SOW	Statement Of Work
SPECSINTACT	Specifications-kept-Intact
SPOC	Single Point-Of-Contact
SSA	Source Selection Authority

SUB	Subcontractor
T.	
TAB	Testing, Adjusting, and Balance
TM	Technical Manual
U.	
UCS	Utilities Control System
UPN	Unique Project Number
USGBC	U.S. Green Building Council
V.	
VE	Value Engineering
W.	
WBDG	Whole Building Design Guide
WFF	Wallops Flight Facility
WSTF	White Sands Test Facility
Y.	
YR	Year

APPENDIX C: Forms and Instructions

NASA Forms and Instructions

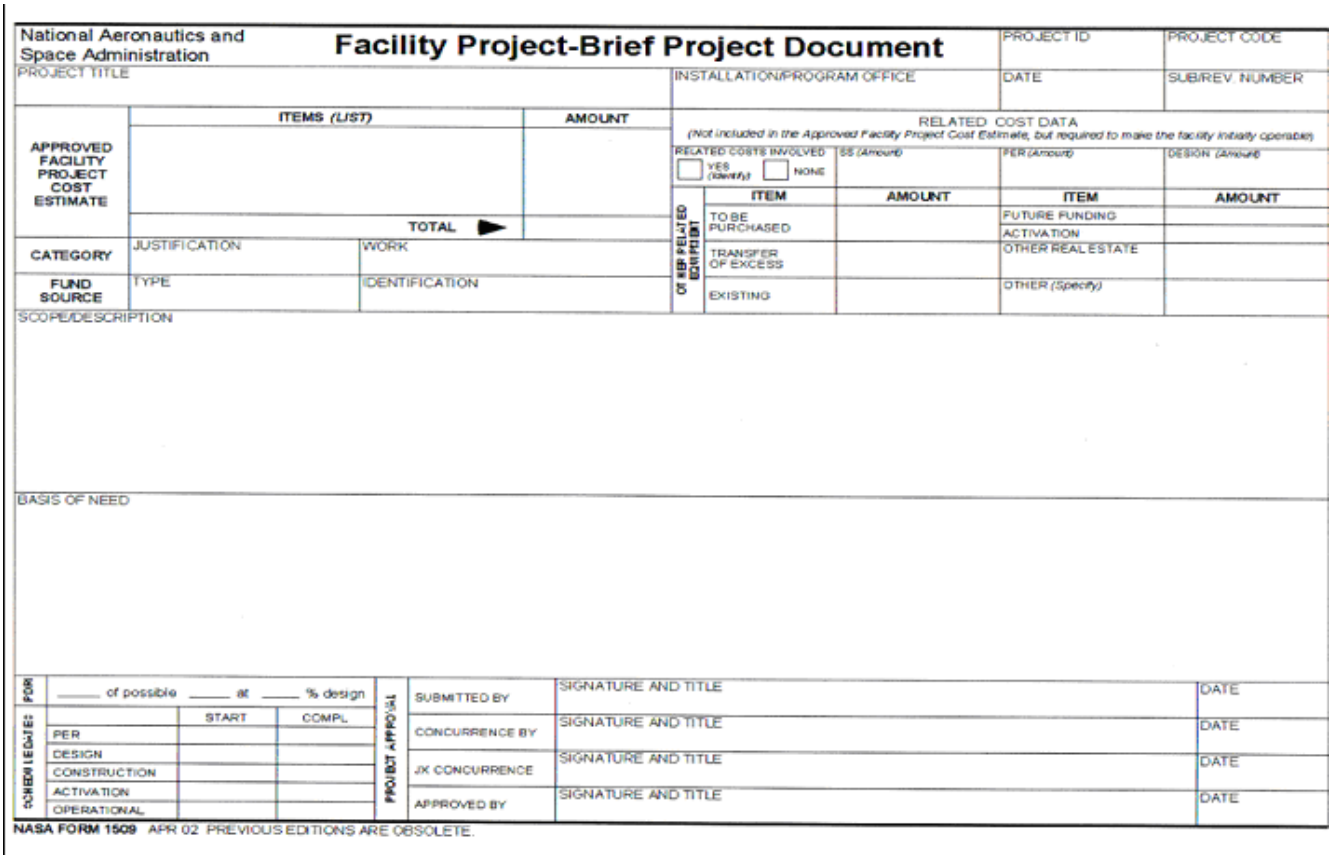
Title	Form Number
C.1 Facility Project - Brief Project Document	1509
C.2 Facility Project Cost Estimate	1510
C.3 Flash Bid Report	1579
C.4 Facility Project Pre-advertisement Review Checklist	1580
C.5 Long Form Writeup	Long Form Writeup

Other Forms/Formats Applicable to CoF Projects - Samples Only

C.6 Allotment Authorization	NASA Form 504
C.7 Resources Authority Warrant	NASA Form 506A
C.8 Transfer and/or Notification of Acceptancet of Accountability of Real Property	NASA Form 1046
C.9 Notification of Real Property Transfer	NASA Form 1046A
C.10 Minor Facility Projects - Summary Brief Project Document	NASA Form 800/01
C.11 Transfer and Acceptance of Military Real Property	DD 1354
C.12 Performance Evaluation - Construction Contracts	SF 1420
C.13 Architect-Engineer and Related Services Questionnaire	SF 254
C.14 Architect-Engineer Related Questionnaire for Specific Project	SF 255
C.15 Example - POP 5-Year Plan Submittal	Format

NASA Form 1509

Facility Project-Brief Project Document



National Aeronautics and Space Administration

Facility Project-Brief Project Document

PROJECT ID | PROJECT CODE

PROJECT TITLE | INSTALLATION/PROGRAM OFFICE | DATE | SUB/REV. NUMBER

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (LIST)	AMOUNT
TOTAL ▶	

CATEGORY | JUSTIFICATION | WORK

FUND SOURCE | TYPE | IDENTIFICATION

RELATED COST DATA
(Not included in the Approved Facility Project Cost Estimate, but required to make the facility initially operable)

RELATED COSTS INVOLVED ☐ YES (Identify) ☐ NONE | OE (Amount) | PER (Amount) | DESIGN (Amount)

OF IEB RELATED EXHIBIT

ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED		FUTURE FUNDING	
		ACTIVATION	
TRANSFER OF EXCESS		OTHER REAL ESTATE	
EXISTING		OTHER (Specify)	

SCOPE/DESCRIPTION

BASIS OF NEED

PDR: _____ of possible _____ at _____ % design

SCHEDULE DATES:

	START	COMPL.
PER		
DESIGN		
CONSTRUCTION		
ACTIVATION		
OPERATIONAL		

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY		
CONCURRENCE BY		
JX CONCURRENCE		
APPROVED BY		

NASA FORM 1509 APR 02 PREVIOUS EDITIONS ARE OBSOLETE.

Figure C.1-a NASA Form 1509, Facility Project - Brief Project Document

NASA Form 1509 (Continuation)

Facility Project-Brief Project Document

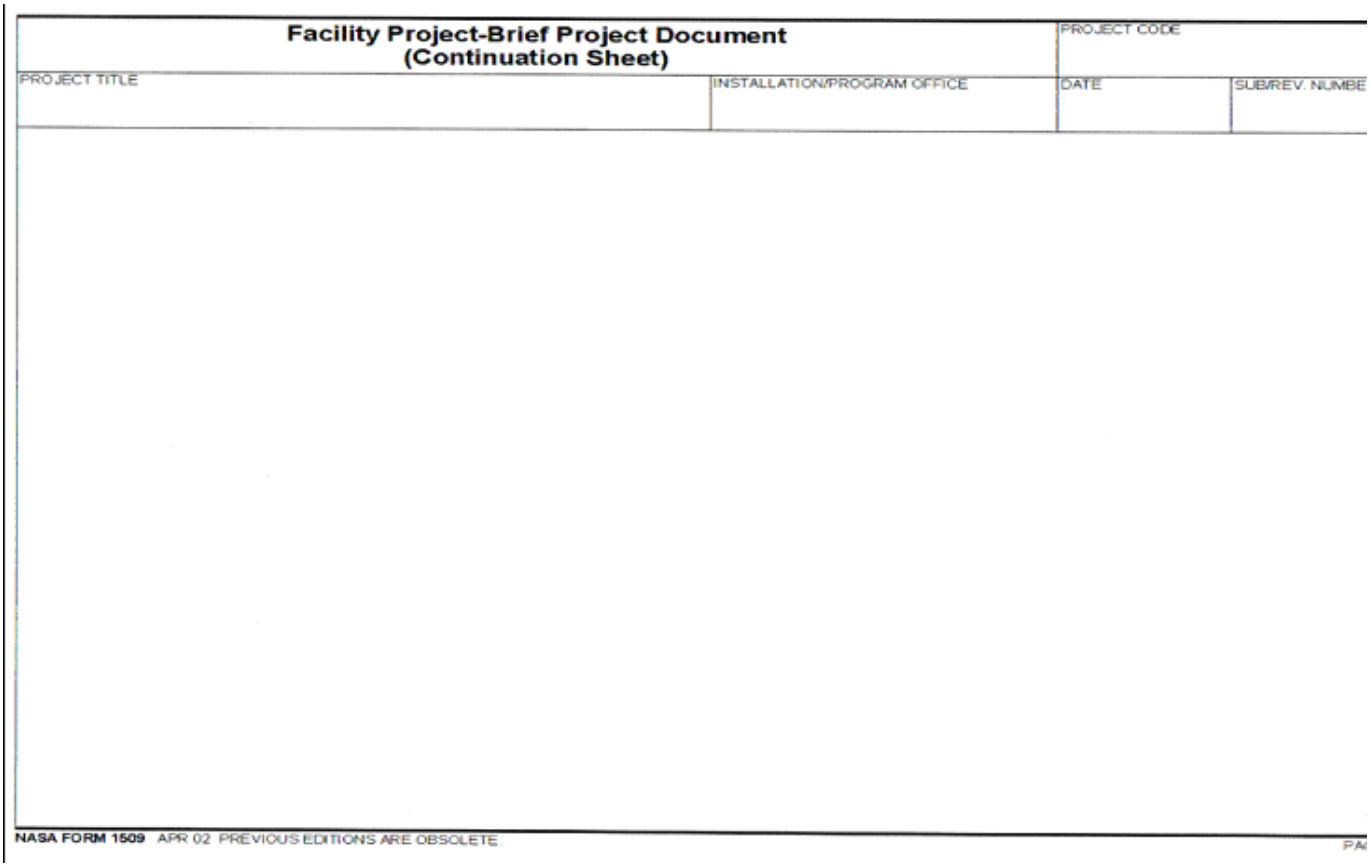

Facility Project-Brief Project Document
(Continuation Sheet)
PROJECT CODE
PROJECT TITLE
INSTALLATION/PROGRAM OFFICE
DATE
SUB/REV. NUMBE
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Figure C.1-b NASA Form 1509, Facility Project - Brief Project Document (Continuation)

C.1 Instructions for NASA Form 1509, Facility Project - Brief Project Document

Instructions for preparation of Facility Project - Brief Project Document, NASA Form 1509, follows. The bolded titles in the following paragraphs provide the cross references to the NASA Form 1509 shown in Figures C.1-a and C.1-b..

C.1.1 Project ID - an identification number assigned by the submitting organization.

C.1.2 Project Code - instructions for assigning the project code are contained in the Facility Project Management System (FPMS).

C.1.3 Project Title - a short, descriptive title that includes the type of work.

a. Discrete Projects. The title should include the type of work and describe the primary focus of the project accomplishment. Official facility name(s) can be useful but are not required. Facility numbers generally are not used in discrete project titles, program names, or relationships shall not be used.

b. Non-discrete Projects. The title should include the type of work and facility name(s) as used in approved master plans, and assigned facility number(s) (e.g., Construction of Solar Simulator Facility (110) and Rehabilitation of Lunar Simulator Facility (130)). When more than one facility is involved in a single project, use the following format: Rehabilitation of Three Administrative Facilities (104, 202, 301).

C.1.4 Installation/Program Office - indicate the appropriate Field Installation and the Headquarters organization advocating the project (e.g., GRC/R or MSFC/M). If the project location is different from the appropriate Field Installation, the installation would be indicated as shown in the following examples:

a. "GRC/PB" for Plum Brook Station, and

b. "MSFC/MAF" for Michoud Assembly Facility

The Headquarters office having advocate status is indicated as follows:

a. M Office of Space Flight (OSF),

b. R Office of Aerospace Technology (OAT),

c. S Office of Space Science (OSS), and

d. Y Office of Earth Science (OES).

C.1.5 Date - indicate the date of the preparation of the form.

C.1.6 Submission/Revision Number - the submission/revision number provides a record of the submissions of the Field Installations and approvals of Headquarters.

a. Centers - indicate consecutively with capital letters. The initial submission is A. Subsequent revisions are B, C, and

b. Headquarters - indicate consecutively with numbers. First approval is 0. Subsequent approvals are 1, 2, 3.... For example, the submission/revision number will be B/1 after the second submission of the project by the Field Installation and the second approval of the project by Headquarters.

C.1.7 Approved Facility Project Cost Estimate - the cost estimate will fully disclose all costs including contractor services to execute the planned facility project and make it operational (excluding related cost data described in Subparagraph (9)). The anticipated amounts for labor, materials, supplies, collateral equipment, land acquisition, and site development for planned work are included in the estimate.(Guidelines for collateral equipment are provided in a subsequent paragraph on this subject.)

a. It is recognized that in certain instances the planning for the execution of the facility project will include the use of engineering and construction management services that are provided by contract. When applicable, the cost estimate will identify the cost for these contractual services as follows:

(1) Engineering services for review and analysis of shop drawings, and

(2) Construction management services including evaluation of work progress, preparation and maintenance of critical path method (CPM) network diagrams, resolution of problems due to unanticipated changes in scheduled work, and other similar services.

b. The cost for the accomplishment of specialized craftwork, when it is planned that NASA civil service employees will provide this, will be identified and shown as a separate element in the estimate.

c. The cost estimate may be a total for the entire project or broken down into specific segments or work packages. For a discrete project, the approved facility project cost estimate listed on the NASA Form 1509, is the maximum that can be expended on the project or specific segments or work packages thereof. The delegated approval authority must approve any increase before additional obligations may be incurred. Provisions for increases in cost estimates for minor projects are provided on the Minor Facility Projects Summary Brief Project Document, Form 800/01. The approved facility project cost for routine Field Installation funded facility work may be exceeded by up to 15-percent (project cost not to exceed $500,000) provided there is no change in scope. A Facility Project Cost Estimate (NASA Form 1510) is required for each facility project estimated to cost $75,000 or more. It should be noted that, although preparation of the NASA Form 1510 satisfies cost estimate requirements for preparation of the budget, more detailed and updated estimates will be necessary as design and construction activities proceed.

d. The cost estimate must also provide a reasonable amount for contingencies, usually 10-percent. The FPM uses the latitude provided by the contingency funds to resolve local construction problems. Established contractual, and fiscal management and control procedures will be followed in the use of contingency funds. The basic premise should be to complete the project work on schedule and within the approved amount. The general guidance is that, when establishing the amount for contingencies, consideration should be given to such factors as the nature and scope of work, material availability, interfaces or dependencies with other planned work or other items that could impact the work, and schedule. Some of these factors are illustrated in the following:

(1) A modest contingency amount should suffice when the work is to construct a standard structure, and

(2) It is prudent to provide an increased contingency amount when there is the potential for encountering significant

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unanticipated problems such as modifying an existing space launch complex.

e. If the project is to be carried out by a construction agent, the estimated cost must also include the costs associated with the use of such an agent during the construction phase. The estimated cost of each facility project must be based on the most recent related cost experience available in the geographical area involved and contain the projection of such experience to reflect anticipated future cost conditions. Related costs are not included in the facility project cost estimate but must be identified elsewhere on the NASA Form 1509 under related costs (paragraph (9)).

f. Collateral equipment encompasses building-type equipment, built-in equipment, and large substantially affixed equipment/property that is normally acquired and installed as a part of a facility project. A definition of this term is included in Appendix A.

g. Guidelines for determining whether equipment is to be considered substantially affixed - the question of whether a unit of equipment is to be substantially affixed is one resolved only by proper judgment in consideration of the actual unit of equipment coupled with its relationship to, or connection with, the building or structure involved. If there is a clear and significant relationship or connection, then the unit of equipment is considered to be substantially affixed and, thus, designated as collateral equipment. It is required that in each case the judgment applied be realistic, practical, and consistent. This situation being a judgment decision, there are no clear-cut parameters that can or should be mechanically applied in order to reach a determination. This determination involves certain key considerations such as the extent of actual installation work involved, the degree to which special foundations or utility services are required, and the nature and extent of facility restoration work which would be involved if the unit of equipment were to be removed.

h. These and other considerations must be reviewed together to arrive at the proper determination as to whether a unit of equipment is substantially affixed or not. In each case, it is necessary to evaluate the relationship or connection, which will exist between the unit of equipment which is under consideration and the building or structure to which it is related.

i. A unit of equipment will, in any event, be considered to be substantially affixed if work described under either of the items below is required and the work is estimated to cost $100,000 or more:

(1) Provide any special foundations, utility services, or other facilities support for a unit of equipment and to actually install the unit, and

(2) Demount the unit of equipment and perform any facility restoration work which might be involved in its removal from the NASA Form 1509, Facility Project-Brief Project Document, related building or structure.

j. Questionable cases involving possible deviations from the foregoing guidelines will be referred to the Director, Facilities Engineering Division, NASA Headquarters, for resolution.

C.1.8 Category: Justification - the categories for justification include:

a. Life Critical - work required to correct conditions that are dangerous to the life and health of personnel with the potential of fatal injuries if they are not corrected.

b. Safety - work required to correct a safety hazard or to provide adequate fire protection for personnel, high-value equipment, materials, or records that are difficult or impossible to replace and that are needed in the performance of mission or other essential tasks.

c. Program Critical - work that is urgently needed to support a specific R&D program or mission and the effort has to be completed by a stated date for the successful accomplishment of that program or mission.

d. Environmental - work required to correct an existing condition that may pollute the environment. It includes the correction of conditions to meet current environmental regulations. All environmental projects will indicate Environmental on this line item as the projects are dictated by environmental regulatory requirements.

e. Energy Conservation - a facility project can include Direct Energy Projects that are principally justified to reduce energy consumption and costs; or Related Energy Projects that are justified for other purposes but do contribute to the reduction of energy consumption.

f. Institutional Critical - work urgently required to correct an existing condition involving institutional facilities such as accelerating deterioration that requires prompt correction. It includes the improvement of utility systems that support major areas of the installation. The emphasis is on priority work that is not program related.

g. Program Related - work required to correct deficiencies in facilities that support R&D programs or missions. It

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includes deterioration that limits support of tests or operations and must be corrected in the current budget year. It also includes direct program projects that do not qualify as program critical projects.

h. Cost Effective - work that is not program critical or institutional critical; but that, if accomplished, would result in demonstrable cost savings or other benefits over a reasonable period of time. Energy Related projects are relevant to this category.

i. Occupational Safety and Health Related - work required to meet current standards of the Occupational Safety and Health Act of 1970. Such work is necessary to improve the working environment for employees but is less urgent than work performed under the category of safety. This category is intended to accomplish work that is clearly needed for full compliance with the law and Executive Order (EO) 12196, Occupational Safety and Health Programs for Federal Employees, as amended.

j. Institutional Routine - work that is clearly necessary in the future but could be deferred to a subsequent budget year if necessitated by budget constraints.

k. Emergency Repair - work that qualifies for funding from the CoF account under the provisions of Section 309 (b), National Aeronautics and Space Act of 1958, as amended.

C.1.9 Category: Work -

C.1.9.1 Categories for work reflect the type of work included in the project. The predominant type is stated first. The following terms should be used: repair, rehabilitation, modification, construction, and land acquisition. The category Work also identifies the fiscal year that the project was submitted in the President's Congressional budget.

C.1.9.2 For minor facility projects, when more than one category of work is involved, the project will be classified in accordance with the predominant work. If a project is 51 percent rehabilitation work and 49 percent construction work, it will be submitted as a rehabilitation project.

C.1.9.3 Additional data for a minor program projects that exceed $500,000 will also be entered in this block. The following applicable entry will be used:

a. FY01 Category A - indicates the project was included and fully defined in the FY01 Congressional budget submission (note: change FY as appropriate),

b. FY01 Miscellaneous Category A - indicates funding for the project was originally planned from resources budgeted for miscellaneous projects in the FY01 Congressional submission (note: change FY as appropriate), and

c. Category C - indicates the requirement for the project has not been recognized in any Congressional budget submission.

C.1.10 Fund Source: Type - the type of funds to be used for the facility project should be indicated as R&D, or CoF. If CoF, insert one of the following fund source code numbers:

a. FY 1995 and subsequent Projects.

(1) 30 - SAT Appropriations for discrete and minor facility projects associated with Science, Aeronautics and Technology (SAT) programs,

(2) 39 - MS Program Appropriations for Minor construction and additions at various locations not exceeding $1.5M,

(3) 43 - MS Program Appropriations not in excess of $200,000 per project for Minor construction and additions, repairs, and modification and rehabilitation of facilities, and

(4) 44 - MS Appropriations for discrete projects for non-program (MS) activities.

b. FY 1995 through FY 1999. 35 - HSF Appropriations for discrete and minor facility projects associated with Human Space Flight (HSF) programs.

c. FY 1997 and subsequent. 37 - MS Program Appropriations for Repair and Rehabilitation and Modification of facilities at various locations not exceeding $1.5M.

d. FY 2000 and subsequent.

(1) 53 - HSF Appropriations for discrete and minor projects associated with the International Space Station HSF.

(2) 55 - HSF Appropriations for discrete and minor projects associated with Launch Vehicles and Payload Operations.

e. A detailed discussion of the fund source identification system is contained in the Financial Management Manual (FMM 9121-56).

C.1.11 Fund Source: Identification - for each facility project a four-digit number is assigned under SAT, HSF, and MS appropriations for FY 1995 and subsequent years (see FMM 9121-30, Facility Project Number). The first and second digits identify the site location or type of work as described in FMM 9121-30 paragraph a. The Third and fourth digits identify the serial number assigned to the project.

C.1.12Related Cost Data - under the concept of full disclosure, all costs related to a facility project that are required to construct or execute the project must be set forth. These related costs must be approved separately, as appropriate, but they are not included in the approved facility project cost estimate (see Appendix D, Facility and Other Related Costs, section D.2, Related Costs.).

a. Related Costs Involved - check appropriate box:

(1) If none provide appropriate data on PER and design from the following: N/A if not required or not accomplished or in-house if accomplished by in-house personnel.

(2) If yes complete all entries. Note: if not required or not applicable or not accomplished, use N/A.

b. SS (Amount) - the cost to prepare special studies. Enter in-house if being done by in-house personnel.

c. PER (Amount) - the cost to prepare a PER including reports, site surveys, soil investigations, Enter inhouse if being done by in-house personnel.

d. Design (Amount) - the cost for the final design of the project. Enter in house if being done by in-house personnel.

e. Other Related Equipment - if equipment (other than collateral equipment which must be part of the facility project) including office furniture is required to make the facility initially operable, the following information must be provided:

(1) To Be Purchased - the total estimated cost for procurement, transportation, and installation of noncollateral equipment to be purchased under program appropriations.

(2). Transfer of Excess - the total book value of the excess equipment (collateral and noncollateral) to be transferred from another NASA Field Installation or Government agency. Estimated costs for transportation and installation of noncollateral equipment are included. For collateral equipment to be obtained by transfer of excess, however, the estimated out-of-pocket transportation, installation, and rehabilitation costs must be included in the approved facility project cost estimate.

(3) Existing - the estimated total value of equipment and real property improvements on-hand at the Field Installation that can be utilized for the project.

(4) Future Funding - show the planned future funding for any subsequent related requirement.

(5) Activation - indicate the estimated costs associated with the installation of noncollateral (ground support) equipment, checkout, and initial operation of the facility that are funded as part of the operational costs (e.g., the installation of ground support equipment, the integration and checkout of combined facility and equipment systems, and the demonstration and acceptance of an operable facility). Enter in-house if accomplished by in-house personnel.

(6) Other Real Estate - indicate the estimated rental costs if applicable. The purchase of land, easements, and rights-of-way must be part of the facility project and is not included in this entry.

(7) Other (Specify) - other related costs not included above (specify).

C.1.13 Scope/Description -

C.1.13.1 A concise, clear statement of the project's physical size and characteristics is identified here. This information should be quantified to the maximum extent possible (e.g., number of buildings, length, width, height, number of stories, basement size, design capacity, gross area, net usable area, amount of heating and cooling, fire and safety features, and special features). A sketch, drawing, or site plan should also be attached if it helps to describe the project. The format for the description should be similar to the format used for OMB and congressional budget submissions. A statement must also be provided indicating completion of the environmental review process and the type of documentation prepared (i.e., Preliminary Environmental Survey (PES), Environmental Analysis (EVAL), FONSI, EIS, and Record of Decision (ROD)). If the environmental process is not complete or normal documentation has not been prepared, a brief explanation must be attached.

C.1.13.2 The project scope described in this entry will be the approved scope of the project during its execution. It cannot be exceeded without prior written approval of the approving authority nor will it be reduced during execution so that functional requirements will not be satisfied.

C.1.14 Basis of Need

C.1.14.1 The basis of need or justification is the most important element of the proposal. It highlights the project's priority and describes and justifies any relationship to any current or new project. Specific engineering studies, economic evaluations, or other special considerations supporting the projects should also be identified.

C.1.14.2 The statement should begin with a concise statement of the functional purpose for which the project is needed.

C.1.14.3 For projects required to satisfy a Federal, state, and local regulation; the regulatory agency dictating the need for the project; and the specific requirement to be met must be clearly stated.

C.1.14.4 The first paragraph is the most important element of the entire justification. It must clearly summarize (in no more than five short sentences) the major elements of the project and identify its necessity. The details that follow the justification must be relative and supportive. This paragraph should be followed by the justification itself. The justification must be complete and factual. Whenever possible, it should specifically refer to related mission or program requirements and to the role of the proposed facility in the mission or program. The justification should clearly establish the requirements for the facility and should indicate the effect on mission or program requirements and to the role of the proposed facility in the mission or program accomplishment if the facility is not provided. Actual or anticipated workload schedules, flight schedules, or any other type of data to support or strengthen the justification should be attached. The justification for projects providing personnel housing should discuss the personnel requirements, deficiencies in existing housing, resulting excessive administrative costs, and plans for the use of the existing space for other purposes or its disposal.

C.1.14.5 Support facilities, such as libraries, auditoriums, and cafeterias, must be justified separately and specifically.

C.1.14.6 The justification should answer the following questions as they apply to the specific proposal:

a. Why is this project necessary today at this location? How will it assist in the accomplishment of missions or tasks? What purpose will this facility serve? Who will use this facility? What is its proposed capacity? How many people will use it? Are the people on board now or must they be recruited?

b. What is being used today to meet this requirement in terms of adequacy, scope, personnel, cost, and condition? Why is it not possible to continue to meet needs in this way?

c. What is the basis for the physical scope requested?

d. If the mission or task involved is now being carried out in other facilities, what disposition will be made of them if the proposed project is approved?

e. If the requested facility is provided, what benefits will accrue? Benefits should be explained and not just listed. Examples include the following:

(1) Improved mission or task performance,

(2) Attraction and retention of high caliber personnel,

(3) Reduction in total human resources required,

(4) Reduction in energy requirements. Higher level protection (insurance) for personnel and property,

(5) Greater responsiveness, reliance, and performance in a mission or task role, and

(6) Amortization or trade-off in leases or costly facility substitutes.

f. If the proposed facility project is not approved, how will the mission or task be carried out? What degradation, hazards, or other adverse impacts must be recognized in such a course of action?

g. What is the required date for having this facility in operation? What is the estimated checkout time following construction? What slippage, if any, can be accepted, and at what impact?

h. Does this facility conform to NASA standards? And is it sited in accordance with approved master plans?

i. Are any components or features of the proposed facility project considered outside the present state-of-the-art in terms of design, fabrication, construction, checkout, or use? If so, what is the planned solution and what are the risks?

j. Does the facility project fulfill necessary safety standards? It is related to the reduction of risks from accident, fire, or other sources, or to the reduction or elimination of air, water, or other environmental pollution? If so, be specific and cite examples.

k. Does the proposed facility duplicate the capability of any similar facility in NASA, other Government agencies, universities, or industry? How detailed was the survey that found no similar facilities? If similar facilities exist, why is the proposed facility needed? The answer must be explained in terms of personnel costs, availability, limitations, and any other factors that will clearly show that the proposed facility is the only reasonable solution to the overall problem.

l. Is the proposed facility to be located in a flood hazard zone? A statement of findings on the evaluation of flood hazards should be included for each proposal where it is applicable. Is the evaluation and final determination in accordance with NPG 8580.1, Procedures and Guidelines for Implementing The National Environmental Policy Act and Executive Order 12114, paragraph 11.3, Floodplains?

C.1.15 PDRI - enter the projects actual PDRI score the total possible score, and the percent of design completion when the scoring was performed.

C.1.16 Schedule Dates - indicates the schedule dates for PER, design, construction (execution), and activation start, and the date the facility must be operational, if appropriate.

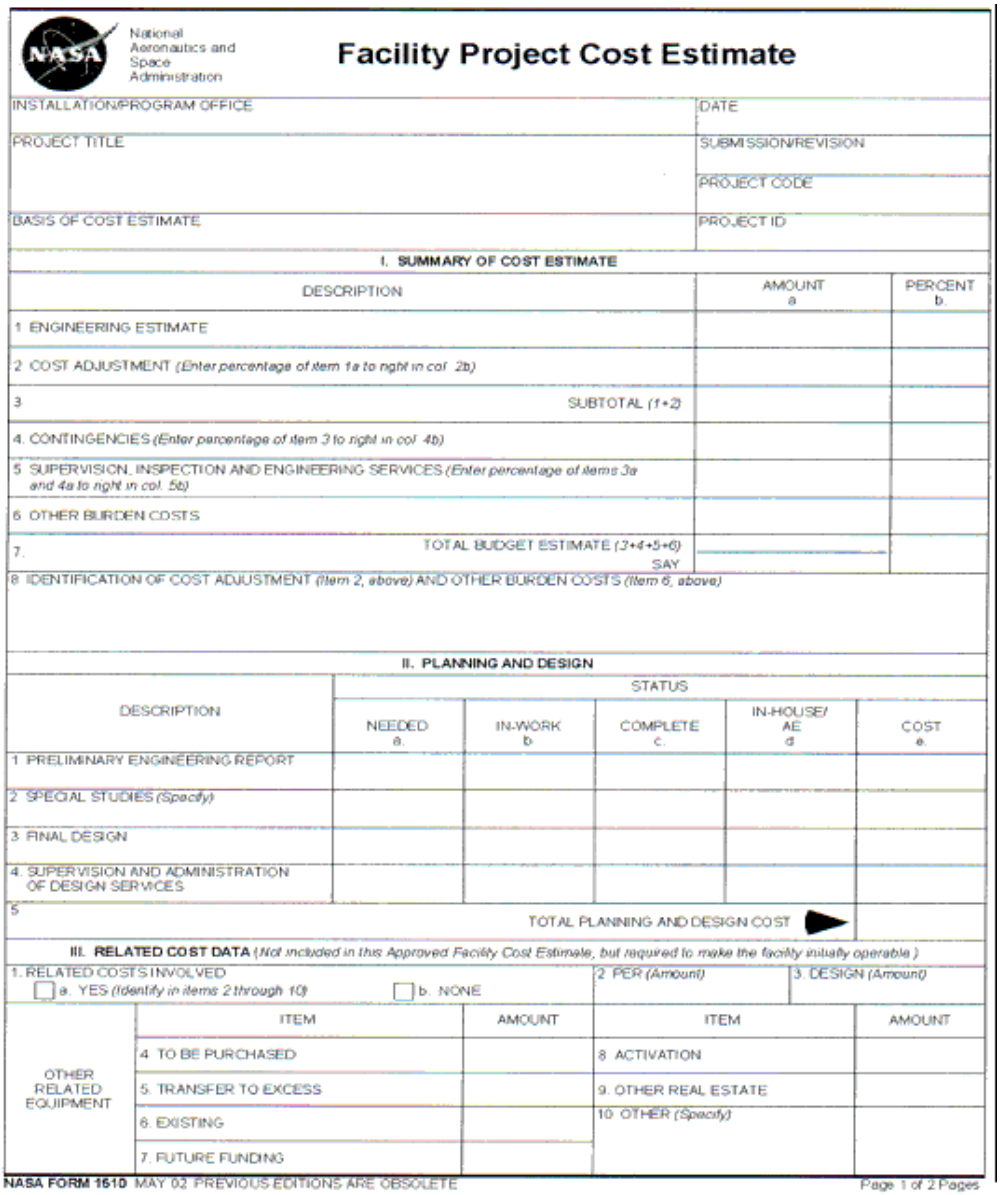
C.1.1.16 Submitted By - the signature and title of the Field Installation Director of the originating installation or designee is required on the project submitted to Headquarters for approval.

C.1.17 Concurrence By, JX Concurrence, Approved By - these entries are to be completed at the Headquarters level for projects submitted to Headquarters for approval. These blocks are also available for use as deemed appropriate for locally approved projects.

C.1.18 (1509 Continuation Sheet- use for any additional supporting data required for the project beyond what is listed in the Form 1509 (see Figure C.1-b).

NASA Form 1510

Facility Project Cost Estimate



National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE	DATE
PROJECT TITLE	SUBMISSION/REVISION
	PROJECT CODE
BASIS OF COST ESTIMATE	PROJECT ID

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a	PERCENT b.
1. ENGINEERING ESTIMATE		
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*		
3. SUBTOTAL *(1+2)*		
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*		
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3+4+5+6)* SAY		

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/ AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT					
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN					
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate, but required to make the facility initially operable.)*

1. RELATED COSTS INVOLVED ☐ a. YES *(Identify in items 2 through 10)* ☐ b. NONE		2. PER *(Amount)*		3. DESIGN *(Amount)*	
OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT	
	4. TO BE PURCHASED		8. ACTIVATION		
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE		
	6. EXISTING		10. OTHER *(Specify)*		
	7. FUTURE FUNDING				

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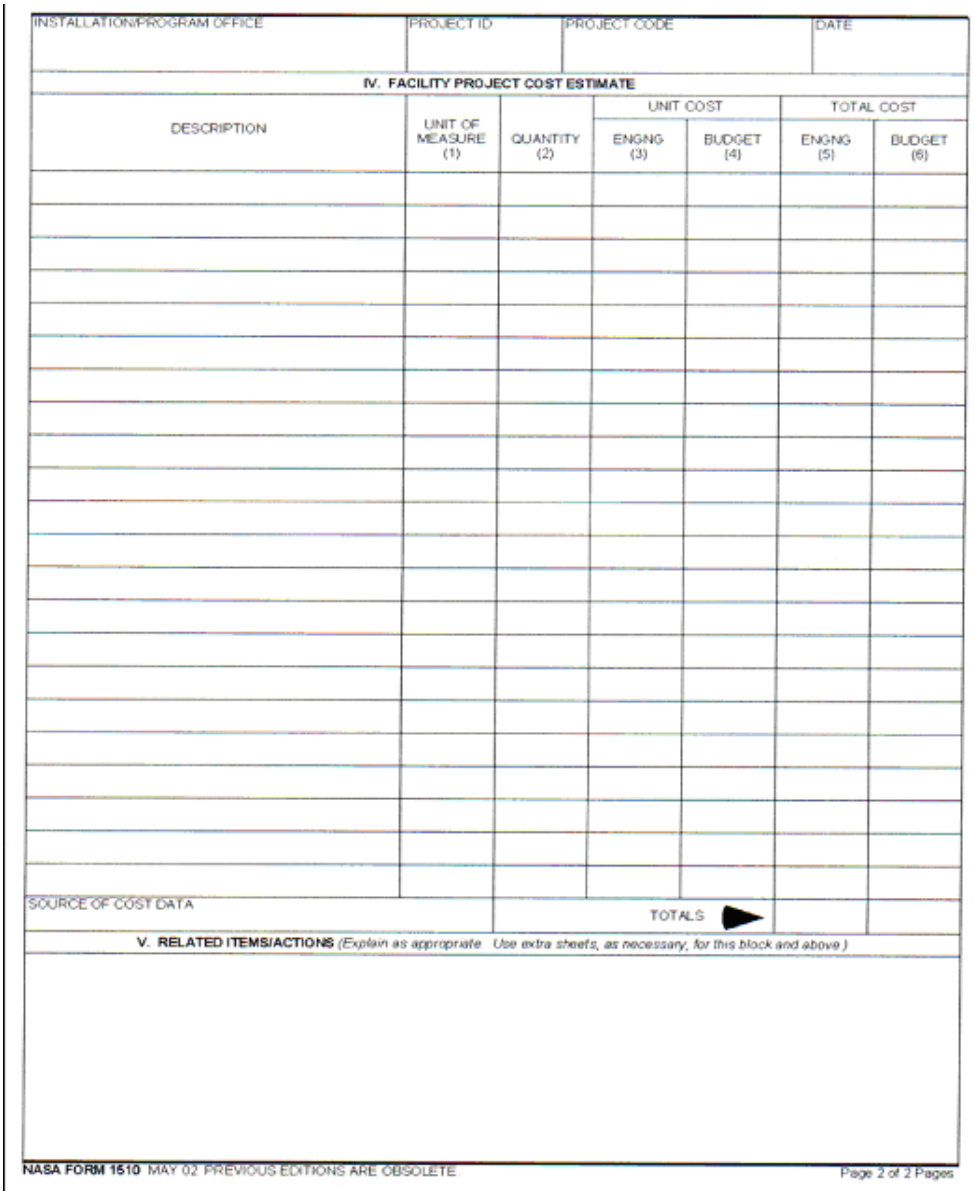
Figure C.2-a NASA Form 1510, Facility Project Cost Estimate



INSTALLATION/PROGRAM OFFICE	PROJECT ID	PROJECT CODE	DATE

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
SOURCE OF COST DATA			TOTALS			

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above.)*

NASA FORM 1510 MAY 02 PREVIOUS EDITIONS ARE OBSOLETE Page 2 of 2 Pages

Figure C.2-b NASA Form 1510, Facility Project Cost Estimate (Continuation)

C.2 Instructions for NASA Form 1510, Facility Project Cost Estimate

Instructions for preparation of Facility Project Cost Estimate, NASA Form 1510, follow. The bolded titles in the following paragraphs provide the cross references to the NASA Form 1510 shown in Figures C.2-a and C.2-b.

C.2.1 Installation/Program Office, Project Title, Date, Submission/Revision Number, Project Code, Prior Project Code - provide the same information as shown on NASA Form 1509.

C.2.2 Basis of Cost Estimate -

C.2.2.1 The basis of the cost estimate should be indicated as follows:

a. Criteria and concepts only,

b. Preliminary engineering report,

c. Partially complete design (35 percent, 60-percent, or 90-percent),

e. Completed final design,

f. Contractor's proposal, and

g. Other (explain).

C.2.2.2 The date and originator of the estimated costs should also be indicated (i.e., June 2001 in-house estimate or June 2001 ABC Architect-Engineer Company).

To provide a uniform base for estimating costs for budget year estimates, the best available local or area experience as of the beginning of the past-year should be used. In addition, the estimated local factor for increased costs should be applied to provide for cost increases (actual and anticipated) from the prior year base point and compounded annually to the project midpoint of construction. The basis of any such factor should be indicated (e.g., Engineering News-Record, March 2001). These costs will be reflected as a percentage added to the engineering estimate and will be included in the space provided under the Summary of Estimate.

C.2.3 I - Summary of Estimate - the amount and percentage of the total estimated cost for the items listed below will be indicated in the appropriate entry blocks.

C.2.3.1 1. Engineering Estimate - the total engineering cost estimate.

C.2.3.2 2. Cost Adjustment - the increase over the base cost used to cover anticipated cost increases compounded annually to the mid-point of the proposed construction period. Headquarters Facilities Engineering Division determines the percentage used. If higher rates for cost growth are needed to reflect local conditions, they must be supported by a special rationale establishing the uniqueness of the local conditions for the project.

C.2.3.3 3. Subtotal of (Engineering Estimate + Cost Adjustment) - represents the project cost without contingencies, supervision, inspection, and engineering services (SIES) and other burden costs.

C.2.3.4 4. Contingencies - indicate normal construction contingencies estimated for changed conditions and essential change orders. Generally, it is 10-percent of the subtotal above.

C.2.3.5 5. Supervision, Inspection and Engineeding (SIES)- the amount for the supervision and administration of the construction contract by a construction agency. Generally, it is 5-10-percent.

C.2.3.6 6. Other Burden Costs - any other burden costs such as Government furnished property (GFP) refurbishment and/or transportation of equipment that may be included in the project.

C.2.3.7 7. Total Budget Estimate - total estimated cost to provide an initially operable facility or total project as set forth in the scope and description of the facility project.

C.2.3.8 8. Identification of Cost Adjustment - provide a description of the elements that constitute these factors.

C.2.4 II - Planning and Design - provide data for the entries below:

C.2.4.1 1. Preliminary Engineering Report (PER) - the actual or estimated cost for the preparation of the PER for the project, normally 1-1/2 to 2 percent, its status, and method of accomplishment should be indicated in the appropriate blocks.

C.2.4.2 2. Special Studies - the actual or estimated cost for any required special studies, normally 2 percent that are not conceptual studies, such as soil borings or structural analyses should be indicated. The specific studies, their status, and method of accomplishment should also be described.

C.2.4.3 3. Final Design - the actual or estimated cost for the preparation of final design, including contractual plans and specifications, the status and method of accomplishment, should be entered.

C.2.4.4 4. Supervision and Administration of Design Services - the amount for supervision and administration of design by the construction agency.

C2.4.5 5. Total Planning and Design Costs - the summary of the items in column f.

C.2.5 III - Related Cost Data - provide a breakout and description of related cost data here and on NASA Form 1509. See Appendix D, Facility and Other Related Costs, section D.2 Related Costs for a partial listing of related cost items and type items to be included.

C.2.6 IV - Facility Project Cost Estimate -

C.2.6.1 The Field Installation must submit this information in considerable detail by each fiscal year for which funds have been provided or will be requested. See paragraph 3.19.3.1 for engineering estimate details and paragraph 3.20 for current cost estimate details. The formal submission to OMB or Congress by Headquarters may result in consolidation or regrouping of certain detailed cost breakdowns (see Figure C.1-2b).

C.2.6.2 The unit of measure, quantity, unit cost, and total cost must be shown for each item that can be reasonably identified and quantified. The use of lump sum (LS) should be avoided as much as possible if meaningful quantities and unit costs can be applied. Any item, estimated to cost over 20 percent of the total project cost estimate, should be subdivided to show components and associated costs. The following are minimum breakdown items as applicable:

a. Interest in Real Estate - if the project includes proposed land acquisition or other interests in real estate, land and easement costs should be identified.

b. Site Development and Utilities Outside 5-Foot Line - costs normally associated with developing the site such as site clearance and demolition, earthwork and landscaping, storm and sanitary sewers, mechanical and electrical utilities, roads, bridges, marine facilities, and airfield pavements should be entered. Also, construction costs associated with the testing; excavation; and removal and treatment and disposal of hazardous contaminated soil, water, and/or groundwater should be identified. Elements of the work should be identified as separate procurement entities if such packaging would optimize procurement strategy and project control.

c. Building/Structure Within 5-Foot Line - includes construction costs for architectural/structural, mechanical, and electrical work; and, the associated collateral equipment. These items are listed in as many procurement packages as necessary to optimize procurement strategy and project control. The specific packaging should be compatible with the standard divisions of labor and/or contractual disciplines of the construction industry to avoid conflicts, overlaps, and other contractual complications. Each package should be numbered (e.g., First - Addition to Building; Second - Modification of Second Floor; Third - Air Conditioning). Each should include further breakouts of the following information.

(1) Architectural/structural - costs normally associated with foundations, structural framing, walls, roofing, finishes, and specialties should be entered.

(2) Mechanical - costs normally associated with mechanical building equipment such as HVAC and plumbing should be included. Built-in, nonseverable mechanical equipment should also be shown. If necessary for optimum procurement, such equipment should be shown as one or more segments.

(3) Electrical - costs normally associated with electrical building equipment such as transformers, motor starters and control centers, lighting fixtures, communications distribution systems, and wiring and distribution systems should be entered. Built-in nonseverable electrical equipment should also be shown. If necessary for optimum procurement, such equipment should be shown as one or more segments.

(4) Fire protection/safety - costs normally associated with fire protection/safety equipment and systems such as sprinkler heads, detectors, alarms.

(5) Environmental - construction costs normally associated with testing, decontamination/ cleanup, and removal and disposal of hazardous contaminated materials within a building. It includes asbestos demolition work such as testing; removal and disposal of the asbestos; building and material decontamination activities; and other such costs necessary in support of the facility project.

(6) Other - any other construction costs should be identified.

d. Other Collateral Equipment Not Included Above - costs for collateral equipment not shown above.

e. Special Features - special items significant enough to identify separately should be included here including plant and personnel protection (e.g., fallout shelters, flood control, and medical facilities); environmental controls necessary for protection of the environment as required by environmental regulations (e.g., air controls, water/groundwater pollution control such as special water/groundwater or sewage treatment, noise controls, and other environmental conditions); and, any secondary functions of the project such as provisions necessary to meet community needs or interfaces with other agencies or organizations. Cost estimates for this section must comply with the following criteria and Federal regulations:

(1) Requirements to protect and enhance the environment for air and water pollution control, noise control, industry waste control, and other similar environmental conditions must meet National Environmental Policy Act of 1969

requirements.

(2) Health and safety requirements are covered in the Occupational Safety and Health Act of 1970 and EO 12196, Occupational Safety and Health Programs for Federal Employees, as amended.

(3) Construction in floodplains and wetlands is generally prohibited.

(4) Construction may be permitted in those cases in which the procedures, such as flood proofing, comparative evaluation, coordination, and public notice have been accommodated; and, it can be substantiated that the only practicable alternative is to construct in the floodplain or wetlands.

(5) Provision for operation of vending facilities by a blind person in all Federal structures occupied by 100 or more Federal employees and all buildings of 15,000 square feet or more that are visited by the public.

(6) Provisions for access by disabled persons including ramps, elevators, and other barrier-free facilities.

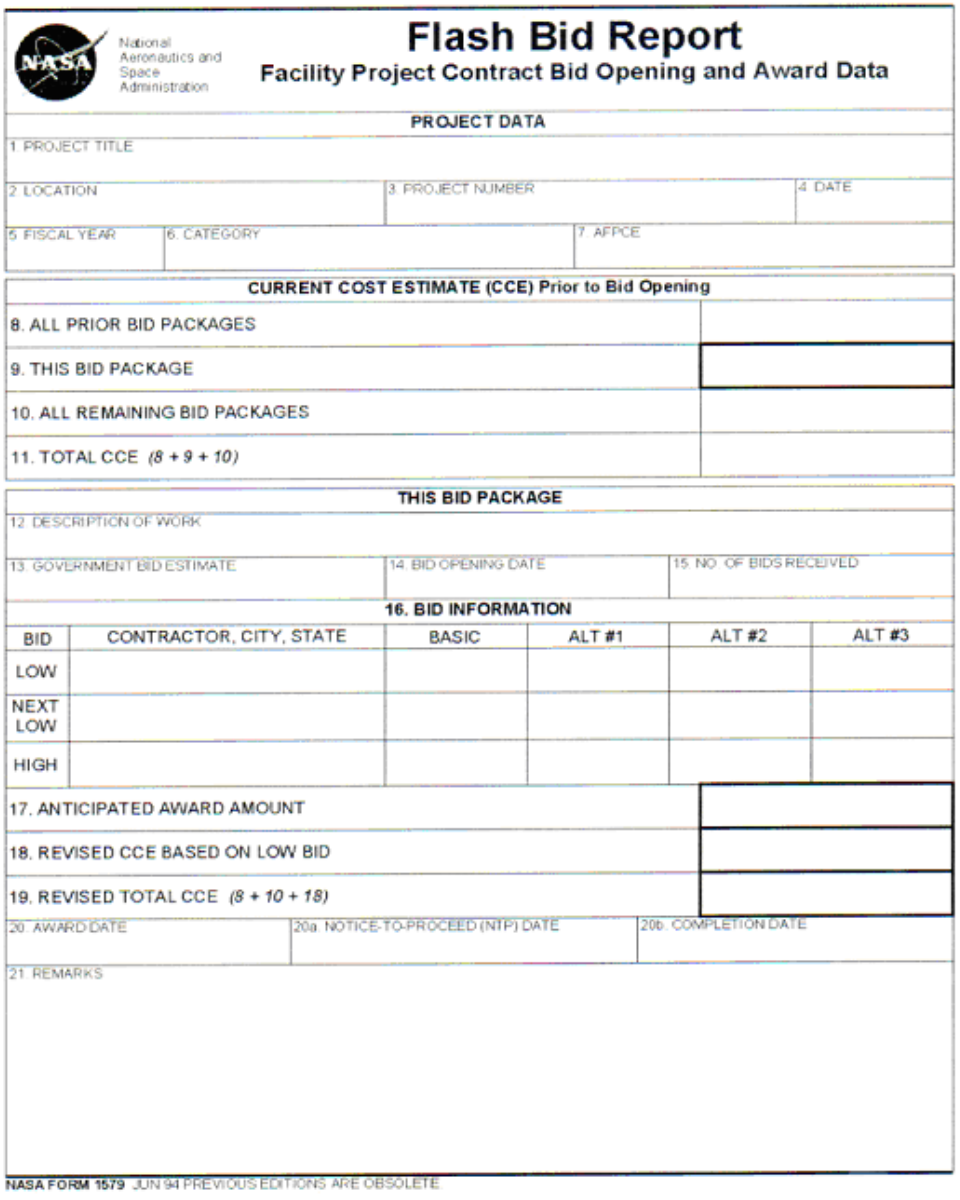
f. Totals -sum of the total costs for the Engineering and Budget columns of the form should be summarized here.

g. Source of Cost Data - source of the cost data (e.g., PER, contractor quotation, quantity take-off, recent procurement history) should be identified in this block.

C.2.7 V - Related Items/Actions - related items (additional procurement, program activity, or facility projects) which are not included under Part III - Related Cost Data (Subparagraph (5) should be explained here).

NASA Form 1579

Flash Bid Report



National Aeronautics and Space Administration

Flash Bid Report

Facility Project Contract Bid Opening and Award Data

PROJECT DATA

1. PROJECT TITLE

2. LOCATION	3. PROJECT NUMBER	4. DATE

5. FISCAL YEAR	6. CATEGORY	7. AFPCE

CURRENT COST ESTIMATE (CCE) Prior to Bid Opening

8. ALL PRIOR BID PACKAGES	
9. THIS BID PACKAGE	
10. ALL REMAINING BID PACKAGES	
11. TOTAL CCE *(8 + 9 + 10)*	

THIS BID PACKAGE

12. DESCRIPTION OF WORK

13. GOVERNMENT BID ESTIMATE	14. BID OPENING DATE	15. NO. OF BIDS RECEIVED

16. BID INFORMATION

BID	CONTRACTOR, CITY, STATE	BASIC	ALT #1	ALT #2	ALT #3
LOW					
NEXT LOW					
HIGH					

17. ANTICIPATED AWARD AMOUNT	
18. REVISED CCE BASED ON LOW BID	
19. REVISED TOTAL CCE *(8 + 10 + 18)*	

20. AWARD DATE	20a. NOTICE-TO-PROCEED (NTP) DATE	20b. COMPLETION DATE

21. REMARKS

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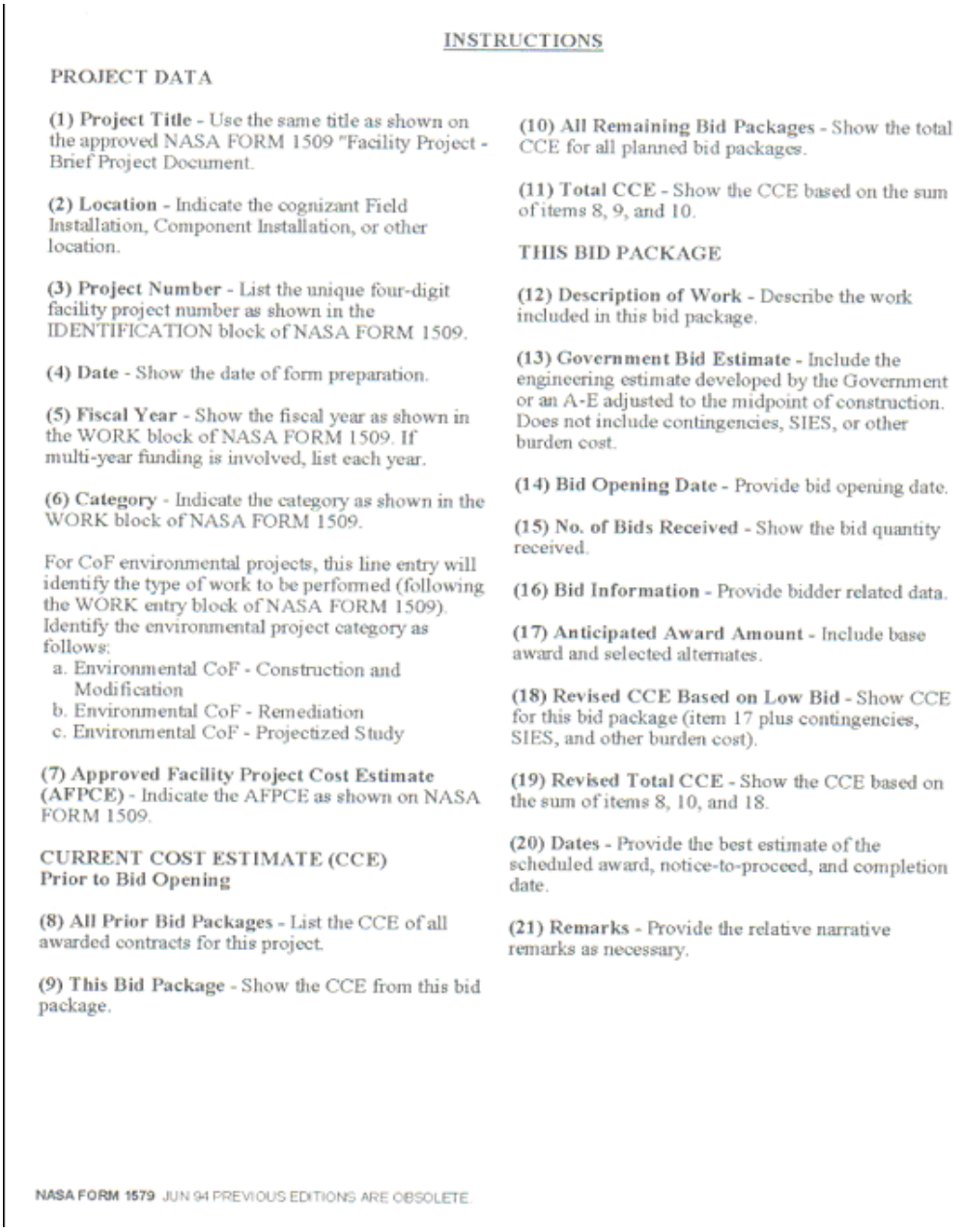
Figure C.3-a NASA Form 1579, Flash Bid Report

C.3 Instructions for NASA Form 1579, Flash Bid Report



INSTRUCTIONS

PROJECT DATA

(1) Project Title - Use the same title as shown on the approved NASA FORM 1509 "Facility Project - Brief Project Document.

(2) Location - Indicate the cognizant Field Installation, Component Installation, or other location.

(3) Project Number - List the unique four-digit facility project number as shown in the IDENTIFICATION block of NASA FORM 1509.

(4) Date - Show the date of form preparation.

(5) Fiscal Year - Show the fiscal year as shown in the WORK block of NASA FORM 1509. If multi-year funding is involved, list each year.

(6) Category - Indicate the category as shown in the WORK block of NASA FORM 1509.

For CoF environmental projects, this line entry will identify the type of work to be performed (following the WORK entry block of NASA FORM 1509). Identify the environmental project category as follows:

a. Environmental CoF - Construction and Modification
b. Environmental CoF - Remediation
c. Environmental CoF - Projectized Study

(7) Approved Facility Project Cost Estimate (AFPCE) - Indicate the AFPCE as shown on NASA FORM 1509.

CURRENT COST ESTIMATE (CCE)
Prior to Bid Opening

(8) All Prior Bid Packages - List the CCE of all awarded contracts for this project.

(9) This Bid Package - Show the CCE from this bid package.

(10) All Remaining Bid Packages - Show the total CCE for all planned bid packages.

(11) Total CCE - Show the CCE based on the sum of items 8, 9, and 10.

THIS BID PACKAGE

(12) Description of Work - Describe the work included in this bid package.

(13) Government Bid Estimate - Include the engineering estimate developed by the Government or an A-E adjusted to the midpoint of construction. Does not include contingencies, SIES, or other burden cost.

(14) Bid Opening Date - Provide bid opening date.

(15) No. of Bids Received - Show the bid quantity received.

(16) Bid Information - Provide bidder related data.

(17) Anticipated Award Amount - Include base award and selected alternates.

(18) Revised CCE Based on Low Bid - Show CCE for this bid package (item 17 plus contingencies, SIES, and other burden cost).

(19) Revised Total CCE - Show the CCE based on the sum of items 8, 10, and 18.

(20) Dates - Provide the best estimate of the scheduled award, notice-to-proceed, and completion date.

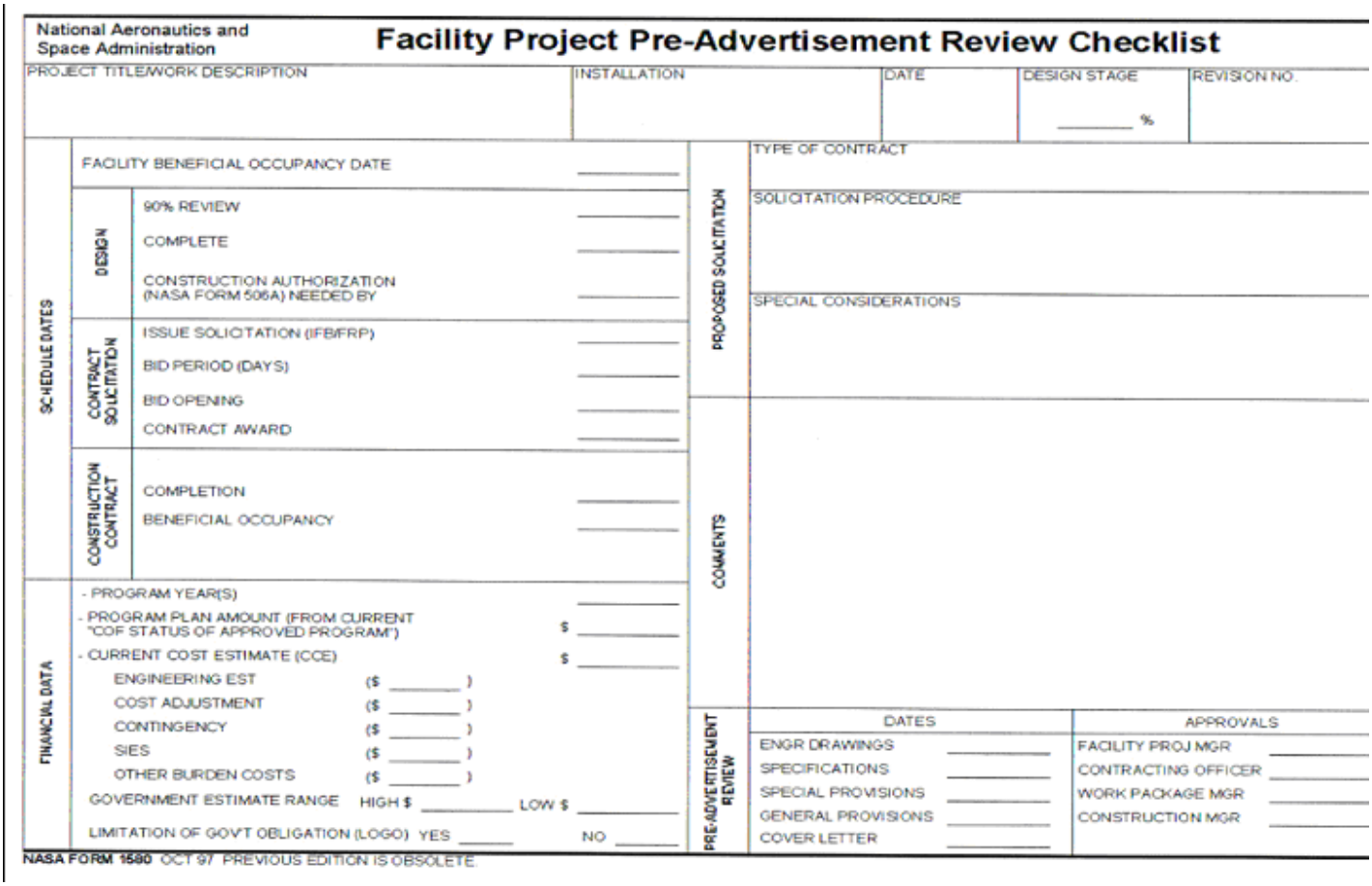
(21) Remarks - Provide the relative narrative remarks as necessary.

NASA FORM 1579 JUN 94 PREVIOUS EDITIONS ARE OBSOLETE.

Figure C.3-b NASA Form 1579, Flash Bid Report Instructions

NASA Form 1580

Facility Project Preadvertisement Review Checklist



National Aeronautics and Space Administration

Facility Project Pre-Advertisement Review Checklist

PROJECT TITLE/WORK DESCRIPTION	INSTALLATION	DATE	DESIGN STAGE	REVISION NO.
			____ %	

SCHEDULE DATES

FACILITY BENEFICIAL OCCUPANCY DATE ____

DESIGN
- 90% REVIEW ____
- COMPLETE ____
- CONSTRUCTION AUTHORIZATION (NASA FORM 506A) NEEDED BY ____

CONTRACT SOLICITATION
- ISSUE SOLICITATION (IFB/FRP) ____
- BID PERIOD (DAYS) ____
- BID OPENING ____
- CONTRACT AWARD ____

CONSTRUCTION CONTRACT
- COMPLETION ____
- BENEFICIAL OCCUPANCY ____

FINANCIAL DATA
- PROGRAM YEAR(S) ____
- PROGRAM PLAN AMOUNT (FROM CURRENT "COF STATUS OF APPROVED PROGRAM") $ ____
- CURRENT COST ESTIMATE (CCE) $ ____
  - ENGINEERING EST ($ ____)
  - COST ADJUSTMENT ($ ____)
  - CONTINGENCY ($ ____)
  - SIES ($ ____)
  - OTHER BURDEN COSTS ($ ____)
- GOVERNMENT ESTIMATE RANGE HIGH $ ____ LOW $ ____
- LIMITATION OF GOVT OBLIGATION (LOGO) YES ____ NO ____

PROPOSED SOLICITATION
- TYPE OF CONTRACT
- SOLICITATION PROCEDURE
- SPECIAL CONSIDERATIONS

COMMENTS

PRE-ADVERTISEMENT REVIEW

DATES		APPROVALS	
ENGR DRAWINGS	____	FACILITY PROJ MGR	____
SPECIFICATIONS	____	CONTRACTING OFFICER	____
SPECIAL PROVISIONS	____	WORK PACKAGE MGR	____
GENERAL PROVISIONS	____	CONSTRUCTION MGR	____
COVER LETTER	____		

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Figure C.4 - NASA Form 1580, Facility Project Preadvertisement Review Checklist

C.4 Instructions for NASA Form 1580, Facility Project Preadvertisement Review Checklist

Instructions for preparation of the Facility Project Preadvertisement Review (PAR) Checklist, NASA Form 1580, follow. The bolded titles in the following paragraphs provide the cross references to NASA Form 1580 shown in Figure C.4.

C. 4.1 Project Title/Work Description - provide a short title that includes the type of project (i.e., Modification of Vibration Test Laboratory, Construction of Central Data Processing Facility).

C.4.2 Installation - provide the name of the cognizant Field Installation.

C.4.3 Date - show the date that the form is prepared.

C. 4.4 Design Stage - provide the facility design progress as of the date shown in C.4.3; and, show this as a percentage of completion of final design (e.g., 90-percent).

C. 4.5 Revision Number - use a numerical sequence to identify revised submissions of the form.

C. 4.6 Schedule Dates - provide the dates for the items shown and bid period in days.

C. 4.7 Financial Data - provide the program year for the project funds and show the program plan amount, the CCE and entries for sub items shown on the sample form, and the Government estimate range. Show whether Limitation of Government Obligation (LOGO) applies.

C. 4.8 Proposed Solicitation -

C.4.8.1 Show the type of contract proposed for the facility project work (e.g., fixed price).

C.4.8.2 Describe solicitation procedure and explain any specialized requirements for fabrication or installation techniques or other items that are major factor in selecting the procedure.

C.4.8.3 Special considerations include factors such as small business set asides or need for special action to meet criteria for minority contractors. Also describe and explain any alternate bid items if applicable.

C.4.9 Comments - include any additional critical information pertinent to the project.

C.4.10 Preadvertisement Review -

a. Dates - show the PAR approval dates for the items shown on the sample form, and

b. Approvals - include the signatures of the key participants in the final PAR.

C.5 Instructions for Long Form Writeup

Instructions for preparation of the Long Form Write Up, follows.

The Long Form Writeup shall be no longer than one page. It is used to describe discrete Construction of Facilities (CoF) projects in the Agency's budget submissions to the Office of Management and Budget (OMB) and the Congress. Following the instructions are examples (Figures C.5-a, C.5-b and C.5-c) of completed Long Form Writeup.

C.5.1 PROJECT TITLE - a short, descriptive title that matches the NASA Form 1509 project title. Discrete project titles should include the type of facility work and describe the primary focus of the project accomplishment. Official facility name(s) can be useful but are not required. Facility numbers generally are not used in discrete project titles, program names, or relationships shall not be used.

C.5.2 INSTALLATION - the full name of the Field Installation, or Component Facility where the projects work is to be performed or is associated.

C.5.3 COGNIZANT OFFICE - the responsible Program Office or other Headquarters Office which is the advocate for the project.

C.5.4 LOCATION - the place, city, county, state, or foreign country as appropriate. When the project includes work in separated locations, the phrase Various Locations is recommended.

C.5.5 FY XX COST ESTIMATE (Thousand of Dollars) - the detailed cost elements supporting the project as specified in paragraph 3.19.3, Section III: Engineering and Budget Estimate.

C.5.6 PRIOR YEARS FUNDING - funds that have been made available for planning, design, and construction of the project from prior years programs shall be provided.

C.5.7 PROJECT DESCRIPTION a brief narrative of the physical size and characteristics of the project to include type of work; land acquisition, construction, repair, rehabilitation and modification, and descriptions such as building name and number; area (i.e., gross and net); length, width, and height; number of floors; architectural work; structural work; mechanical work; major equipment to be installed (describe source and special or high cost features). This project description should be the same or equivalent to that on the NASA Form 1509 for the project.

C.5.8 PROJECT JUSTIFICATION - the justification provides a clear and concise explanation of the functional purposes for which the facility project is needed. It should specify the priority; and, as appropriate, describe and justify any relationship to any current or new program/project. Specific engineering studies, economic evaluations, or other special considerations in support of the project should be identified. The justification must clearly summarize the major elements of the project and identify its necessity. A simple statement expressing a need or desire for a facility will not be adequate. The justification must be complete, clear, thorough, and factual. Whenever possible, specific reference should be made to related program or project requirements; and to the role of the proposed facility in that program or project. The justification should clearly establish the requirements for the facility and should indicate the effect on program or project accomplishment if the facility is not provided. The justification paragraph in narrative form should provide answers to the following questions as appropriate:

a. Why is it necessary to include this project in the BY (timeframe)?

b. In what manner will it assist in the accomplishment of mission, project or tasks? How will the facility be used and by whom?

c. Are there any cost-payback or other efficiency benefits? Show data where possible.

d. What capacity (i.e., production or workload rate, flight rate) will be provided by the proposed facility?

e. What kind or type of development, test checkout, and evaluation functions will be performed in this facility?

f. How many people will this facility house?

g. What alternate solutions were considered to solve this problem/requirement? Why were the alternatives not adopted?

h. What facilities are now being used to meet this requirement in terms of adequacy, scope, personnel, cost, and condition? Why is it not possible to continue to meet needs as they are now being met?

i. Why must the equipment or system be replaced?

j. The rehabilitation and modification will provide what benefits?

k. Is the facility project which is being requested, related to necessary fulfillment of NASA safety standards/criteria; related to the reduction of risks from accident, fire, or other sources; or related to the reduction or elimination of air, water or other environmental pollution? If so, be specific and cite examples.

l. Why must the project be located at the proposed site and/or in this building as opposed to an alternate location?

m. Is an environmental impact statement required? If required, what is its status?

n. Is this project related to or dependent upon another project (e.g., a need to increase capacity of the central heating and cooling plant, fire protection, potable water system, central utility control system, data links)?

o. Address any other peculiar or special requirements not previously covered.

C.5.9 IMPACT OF DELAY - a statement of impacts if the project is not implemented.

C.5.10 Examples of Long Form Writeups

Following are three examples (Figures C.5-a, C.5-b, and C.5-c) of Long Form Writeups for different types of discrete projects. Note that in each case the writeup contains the necessary information, follows the same format, and is one page in length.

Example 1, Discrete Project for Restoration

PROJECT TITLE: **Restore Electrical Distribution System, Phase 4**	INSTALLATION: **Ames Research Center**
COGNIZANT OFFICE: **Office of Aerospace Technology**	LOCATION: **Moffett Field, Santa Clara County, CA**

FY 02 COST ESTIMATE (Thousand of Dollars)	**8,900**	**PRIOR YEARS FUNDING**:	**14,661**
Project Elements:		Construction	13,900
Replace High Voltage Switchgear and Transformers	1,500	Facility Planning and Design	761
Expand Ames Power Monitoring System	1,900		
Install Standby Generation	5,500		

PROJECT DESCRIPTION:

This project will modernize and repair the Center's primary electrical distribution system as part of a phased program to improve reliability. This is the fourth of approximately ten phases estimated to cost $50M. This phase replaces medium voltage switchgear and transformers in 13 buildings. Nine of the buildings will get new medium voltage (7.2kV and 13.8kV) switchgear, circuit breakers, transformers; microprocessor based protective relays, and current and potential transformers (CT's and PT's) to allow connection to the new Ames Power Monitoring System. The other four buildings will get new relays, and CT's and PT's. The Ames Power Monitoring System (APMS) will be expanded to provide monitoring of the major office buildings. It will cover approximately 84 buildings with an actual total of approximately 50 hardware points (some of the buildings share the same points.) This phase also installs a 3.2 mega-watt Standby

Generation/Un-interruptible Power Supply (UPS) to provide clean and continuous power for the Numerical Aerodynamic Simulation Facility (N258). Fuel storage tanks will be installed to provide extended hours of continuous operation. New 13.8kV switchgear, with the associated CT's, PT's, transformers, and relays will also be installed to interface the UPS to the existing N258 power system.

PROJECT JUSTIFICATION:

The existing 1945 vintage, Center-wide electrical system at Ames is worn out and unreliable. As a result, Ames has experienced increasing instances of power interruptions that have adversely impacted critical research. The old switchgear is unsafe to operate, and it is difficult to maintain because replacement parts are no longer available. New microprocessor based protective relays are more precise which will make for better relay coordination. New potential and current transformers are needed to provide data for the new Ames Power Monitoring System. The existing APMS data transmitted is not dependable and the accuracy of measurement is unpredictable. In addition to previous phases of the APMS task that allowed the monitoring of the major research facilities, this phase will connect the remaining major buildings to provide complete measurement and management of the electrical system at Ames. The APMS is a vital tool in today's rapidly changing and sometimes unreliable electric power supply environment. The Numerical Aerodynamics Simulation (NAS) facility is required to provide services on a 24-hour/7-day basis. Due to the rapidly changing electric power supply landscape, the electric utilities can no longer be depended upon to provide a reliable supply of power for the NAS. A UPS system is the only viable solution to ensure clean and uninterrupted electric power for this vital facility.

IMPACT OF DELAY:

Risk of injury to personnel maintaining hazardous switchgear and transformers would continue. In addition, power outages caused by electrical equipment failure would continue to not only adversely interrupt mission-critical research across the Center, but also prevent the Center from operating in an efficient, cost effective manner.

Figure C.5-a Example Long Form Writeup for Restoration Project

Example 2, Discrete Project for Repair

PROJECT TITLE: **Repairs to Air Conditioning Systems, Various Facilities**	INSTALLATION: **Langley Research Center**
COGNIZANT OFFICE: **Office of Aerospace Technology**	LOCATION: **Hampton, VA**

Sprinkler System

FY 02 COST ESTIMATE (Thousands of Dollars)	**3,300**	**PRIOR YEARS FUNDING:**	**532**
Project Elements:		Construction	---
Building 1239C:		Facility Planning and Design	532
Architectural, General, Controls & Electrical	400		
HVAC System	900		
Building 1299:			
Architectural, General, Controls & Electrical	750		
HVAC System	1,100		
150			

PROJECT DESCRIPTION:

A new variable air volume (VAV) system comprised of fan powered VAV terminal units with a hot water reheat coil will be utilized in Building 1299 and 1293C. A variable speed air handler with a variable frequency drive will be

installed in the mechanical room and utilize chilled water from the existing air-cooled package chillers. A steam to hot water converter will provide hot water to the VAV heating coils. A direct digital control system will allow control and monitoring from Building 1215. The existing absorption chiller will be replaced with a new package unit in Building 1293C. The chiller will use the existing underground water lines. The cost includes piping modifications, new chilled water controls, and new chilled water pump. This project also replaces the control system and installs equipment for dehumidification and pre-treatment of the make-up air. The fume hood industrial exhaust and make-up air will be replaced. This equipment is needed to bring the facility up to standard.

PROJECT JUSTIFICATION:

It has been determined that the status quo is not an option since it cannot provide the required life safety and process requirements needed for the facilities to pursue new work and accomplish their missions. These air conditioning units have reached the end of their useful lives. The equipment is old, unreliable, and incapable of performing under stress, such as maintaining consistent temperature levels in the summertime. The fume hood system deficiencies do not maintain the required exhaust face velocities and make-up air to meet current safety and industrial ventilation requirements and standards. The number of service calls is increasing and maintenance costs are high. The majority of this equipment was identified for replacement by the Facility Assessment Review conducted in 1993.

IMPACT OF DELAY:

People would continue to work in deteriorated substandard facilities, which adversely affects morale and productivity and could compromise the health and safety of personnel. The air conditioning and fume hood systems are critical to the operations in these facilities. Failure of this equipment affects performance and making emergency repairs is expensive and causes significant disruptions.

Figure C.5-b Example Long Form Writeup for Repair Project

Example 3, Discrete Project for Rehabilitation and Modification

PROJECT TITLE: **Rehabilitate and Modify Productivity Enhancement Complex**	INSTALLATION: **Marshall Space Flight Center**
COGNIZANT OFFICE: **Office of Space Flight**	LOCATION: **Madison County, Alabama**

FY 02 COST ESTIMATE (Thousands of Dollars):	**3,600**	**PRIOR YEARS FUNDING:**	**288**
Project Element:		Construction	----
Architectural	1,800	Facility Planning and Design	288
Mechanical	1,100		
Electrical	400		
Structural	300		

PROJECT DESCRIPTION:

This project rehabilitates MSFC's Productivity Enhancement Laboratory (Building 4707). Restoration work includes new insulation; floor surfacing; repair or replacement of door components; repairs and modifications to the heating, ventilating, and air conditioning equipment; relocation of an exhaust system; electrical power distribution and lighting improvements; and interior repairs and painting. A new fire suppression system will be installed to reduce fire hazards in this heavily used development laboratory. Modifications in the Filament Winding area of the building will include raising the height of approximately 5,000 square feet of ceiling to match the height of the adjacent Tape Laying Laboratory area and replacing a 5-ton overhead crane with a 15-ton capacity crane to serve both the filament winding and tape laying laboratories.

PROJECT JUSTIFICATION:

Building 4707 is 44 years old and contains approximately 103,000 square feet of combination high bay and low bay laboratory space. The building is critical to many of NASA's technology development and productivity enhancement initiatives. This facility serves as a model of NASA's new way of doing business in respect to reliability, energy efficiency, and safety. Many of the building's system components have exceeded their design life or are inadequate to satisfy existing requirements or operational improvements. The restoration work will improve reliability, reduce energy costs, and modernize the building to match it's function. Improvements to the Filament Winding Facility are required for the fabrication of larger composite structures under improved environmental controls. There is currently no crane in the filament-winding laboratory that can handle large tooling and fabricated structures.

IMPACT OF DELAY:

Delay of this project will cause Building 4707 to continue to deteriorate, increase unplanned disruptions, and prevent safety improvements and optimum use of the facility. With this facility serving as a model of NASA's new way of doing business, reliable operation and energy and safety upgrades are imperative. Restricting the fabrication of large composite structures will impact the Filament Winding Facility. Without the new crane, lift trucks and other ground support equipment must be used and this limits the number of fabrication operations that can be performed in the facility. Furthermore, composite structures fabricated in the laboratory are extremely sensitive to contaminants generated by fork trucks and other lift vehicles.

Figure C.5-c Example Long Form Writeup for Rehabilitation and Modification Project

Other Forms Applicable to CoF Projects - Samples Only

Following is a list of forms utilized in various phases of the CoF program.

C.6 NASA Form 504, Allotment Authorization, Figure C.6.

C.7 NASA Form 506A, Resources Authority Warrant, Figure C.7.

C.8 NASA Form 1046, Transfer and/or Notification of Acceptance of Accountability of Real Property, Figure C.8-a and back of form Figure C.8-b.

C.9 NASA Form 1046A, Notification of Real Property Transfer, Figure C.9-a and back of form Figure C.9-b.

C.10 NASA Form 800/01, Minor Facility Projects - Summary Brief Project Document, Figure C.10-a, Stipulations sheet Figure C.10-b, and continuation sheet Figure C.10-c..

C.11 DD 1354, Transfer and Acceptance of Military Real Property Figure C.11-a and continuation sheet Figure C.11-b.

C.12 SF 1420, Performance Evaluation - Construction Contracts, Figure C.11-a and continuation sheet Figure C.11-b.

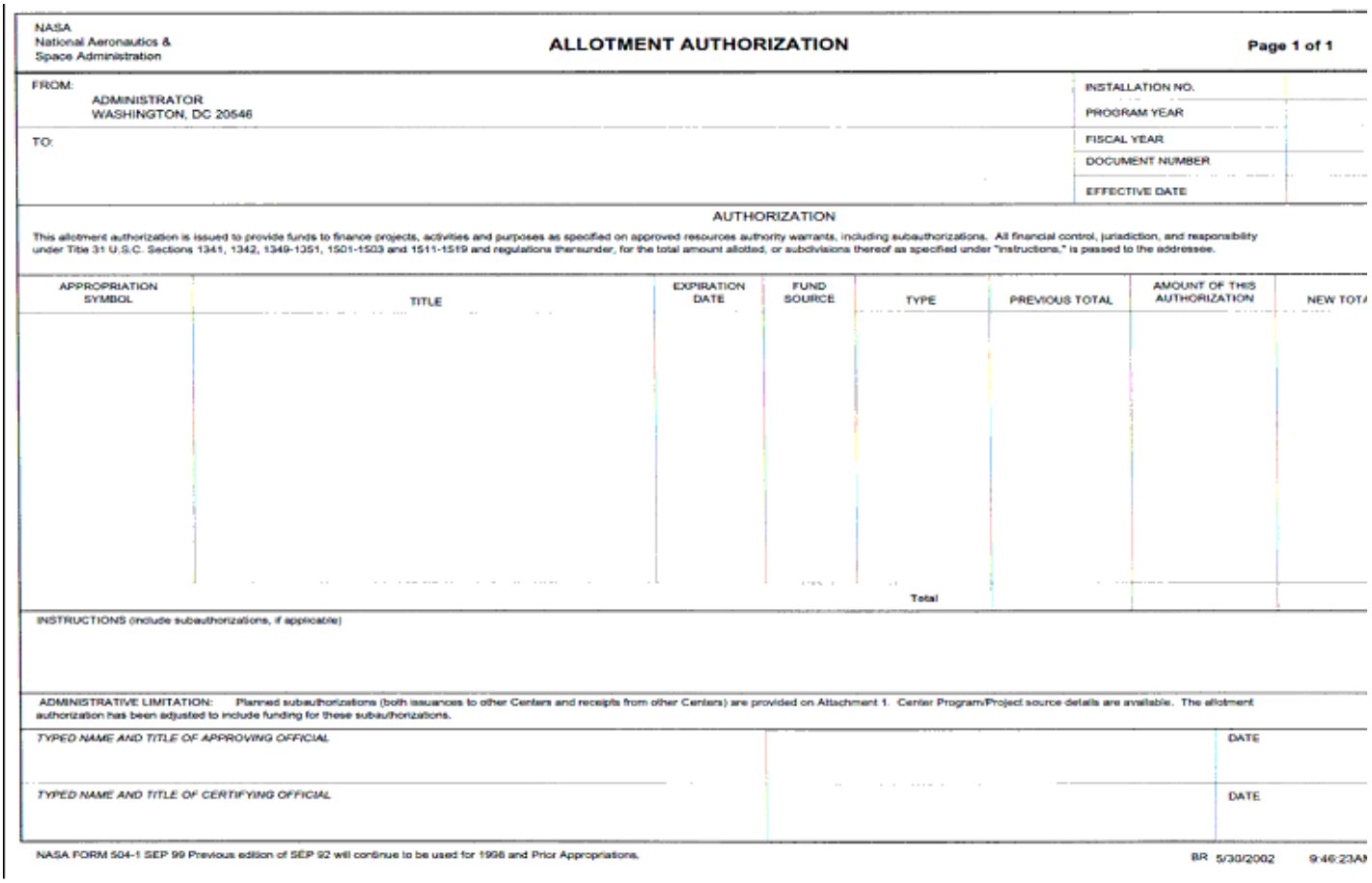
C.13 SF 254, Architect-Engineer and Related Services Questionnaire -This form is available here. Note: It is anticipated SF 330 will replace this form.

C.14 SF 255, Architect-Engineer Related Questionnaire for Specific Project, This form is available here. Note: It is anticipated SF 330 will replace this form.

C.15 Format, Example - POP 5-Year Plan Submittal

C.15 Example - POP 5-Year Plan Submittal

C.6 NASA Form 504, Allotment Authorization



NASA
National Aeronautics &
Space Administration

ALLOTMENT AUTHORIZATION

Page 1 of 1

FROM:
ADMINISTRATOR
WASHINGTON, DC 20546

TO:

INSTALLATION NO.
PROGRAM YEAR
FISCAL YEAR
DOCUMENT NUMBER
EFFECTIVE DATE

AUTHORIZATION

This allotment authorization is issued to provide funds to finance projects, activities and purposes as specified on approved resources authority warrants, including subauthorizations. All financial control, jurisdiction, and responsibility under Title 31 U.S.C. Sections 1341, 1342, 1349-1351, 1501-1503 and 1511-1519 and regulations thereunder, for the total amount allotted, or subdivisions thereof as specified under "instructions," is passed to the addressee.

APPROPRIATION SYMBOL	TITLE	EXPIRATION DATE	FUND SOURCE	TYPE	PREVIOUS TOTAL	AMOUNT OF THIS AUTHORIZATION	NEW TOTA
				Total			

INSTRUCTIONS (include subauthorizations, if applicable)

ADMINISTRATIVE LIMITATION: Planned subauthorizations (both issuances to other Centers and receipts from other Centers) are provided on Attachment 1. Center Program/Project source details are available. The allotment authorization has been adjusted to include funding for these subauthorizations.

TYPED NAME AND TITLE OF APPROVING OFFICIAL — DATE

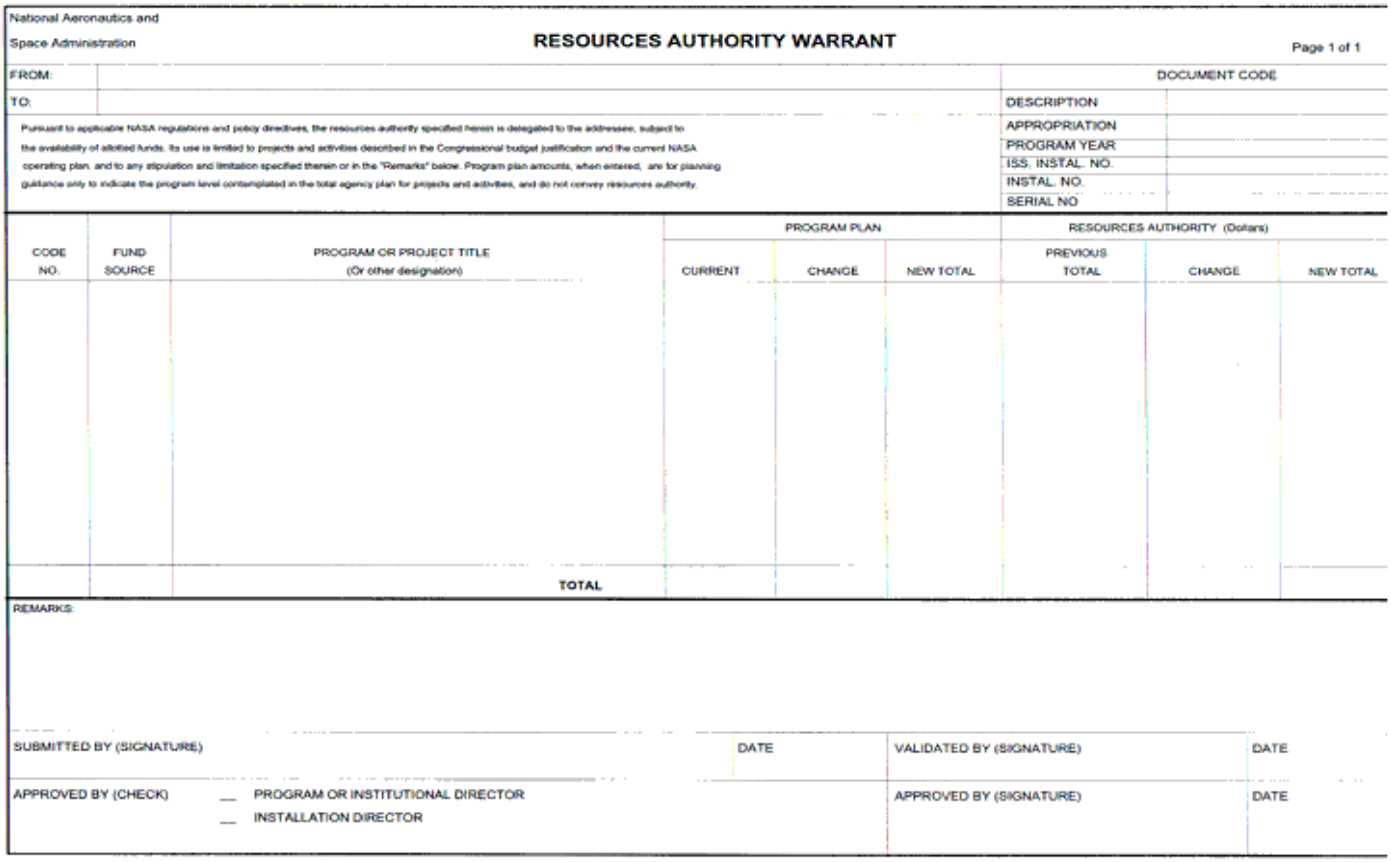
TYPED NAME AND TITLE OF CERTIFYING OFFICIAL — DATE

NASA FORM 504-1 SEP 99 Previous edition of SEP 92 will continue to be used for 1998 and Prior Appropriations.

BR 5/30/2002 9:46:23AM

Figure C.6 - NASA Form 504, Allotment Authorization

C.7 NASA Form 506A, Resources Authority Warrant



National Aeronautics and Space Administration

RESOURCES AUTHORITY WARRANT

Page 1 of 1

FROM:

TO:

DOCUMENT CODE

DESCRIPTION

APPROPRIATION

PROGRAM YEAR

ISS. INSTAL. NO.

INSTAL. NO.

SERIAL NO.

Pursuant to applicable NASA regulations and policy directives, the resources authority specified herein is delegated to the addressee, subject to the availability of allotted funds. Its use is limited to projects and activities described in the Congressional budget justification and the current NASA operating plan, and to any stipulation and limitation specified therein or in the "Remarks" below. Program plan amounts, when entered, are for planning guidance only to indicate the program level contemplated in the total agency plan for projects and activities, and do not convey resources authority.

CODE NO.	FUND SOURCE	PROGRAM OR PROJECT TITLE (Or other designation)	PROGRAM PLAN			RESOURCES AUTHORITY (Dollars)		
			CURRENT	CHANGE	NEW TOTAL	PREVIOUS TOTAL	CHANGE	NEW TOTAL
		TOTAL						

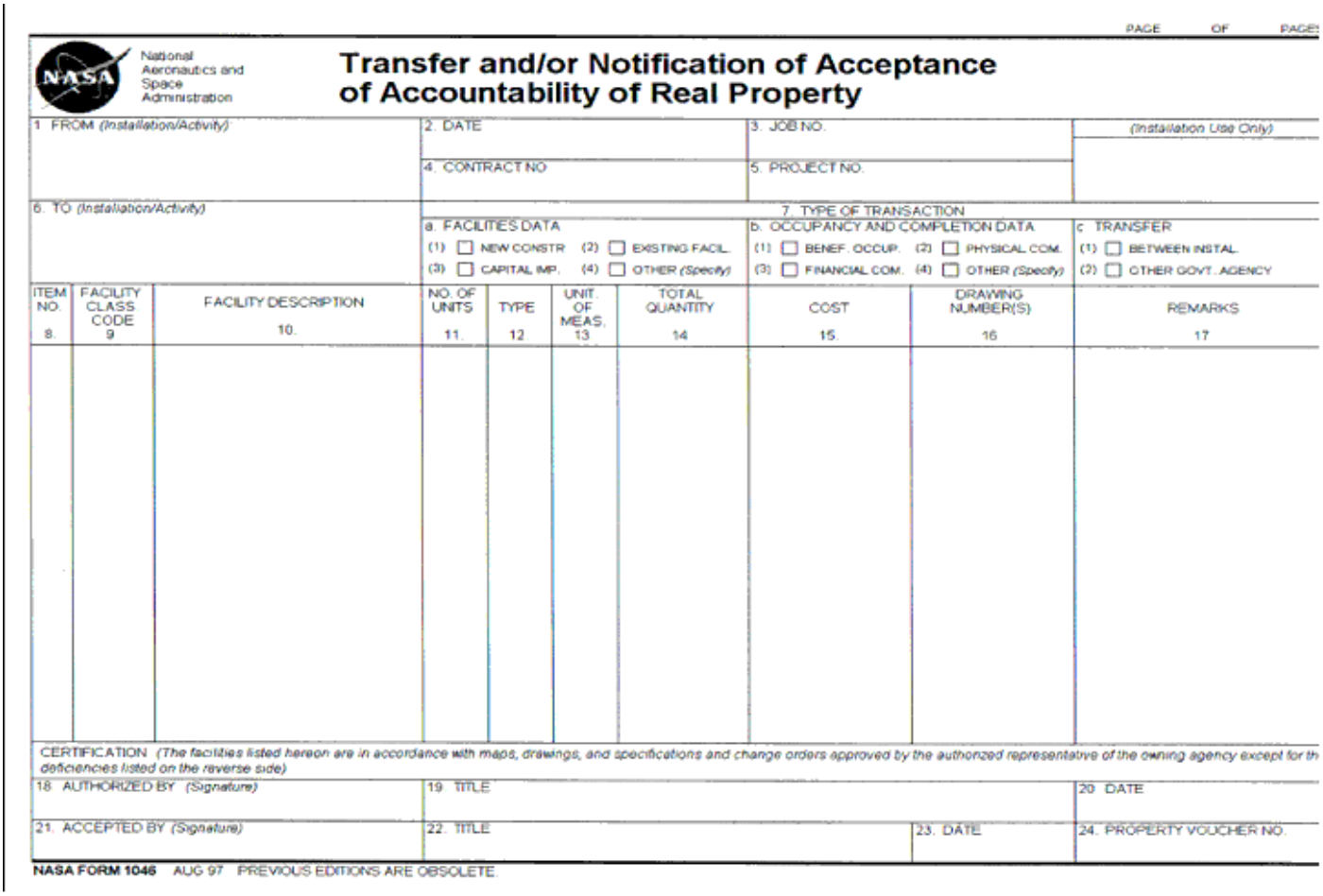
REMARKS:

SUBMITTED BY (SIGNATURE)	DATE	VALIDATED BY (SIGNATURE)	DATE
APPROVED BY (CHECK) __ PROGRAM OR INSTITUTIONAL DIRECTOR __ INSTALLATION DIRECTOR		APPROVED BY (SIGNATURE)	DATE

NASA FORM 506A JUL 97 PREVIOUS EDITIONS ARE OBSOLETE

Figure C.7 - NASA Form 506A, Resources Authority Warrant

C.8 NASA Form 1046, Transfer and/or Notification of Acceptance of Accountability of Real Property



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Transfer and/or Notification of Acceptance of Accountability of Real Property

1. FROM (Installation/Activity)	2. DATE	3. JOB NO.	(Installation Use Only)
	4. CONTRACT NO.	5. PROJECT NO.	

6. TO (Installation/Activity)	7. TYPE OF TRANSACTION		
	a. FACILITIES DATA (1) ☐ NEW CONSTR (2) ☐ EXISTING FACIL. (3) ☐ CAPITAL IMP. (4) ☐ OTHER (Specify)	b. OCCUPANCY AND COMPLETION DATA (1) ☐ BENEF. OCCUP. (2) ☐ PHYSICAL COM. (3) ☐ FINANCIAL COM. (4) ☐ OTHER (Specify)	c. TRANSFER (1) ☐ BETWEEN INSTAL. (2) ☐ OTHER GOVT. AGENCY

ITEM NO. 8.	FACILITY CLASS CODE 9	FACILITY DESCRIPTION 10.	NO. OF UNITS 11.	TYPE 12	UNIT OF MEAS. 13	TOTAL QUANTITY 14	COST 15.	DRAWING NUMBER(S) 16	REMARKS 17

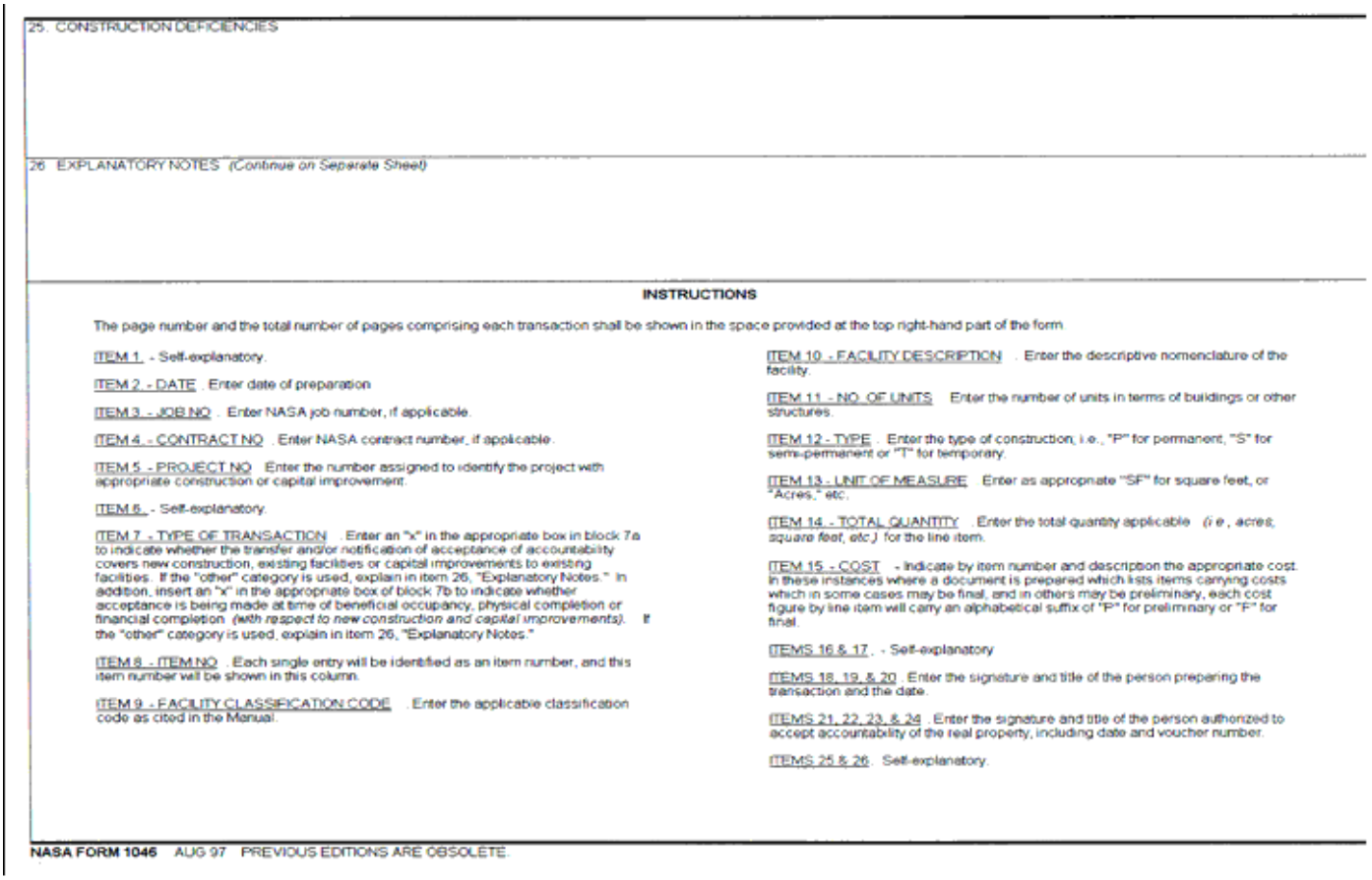
CERTIFICATION (The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the owning agency except for th deficiencies listed on the reverse side)

18. AUTHORIZED BY (Signature)	19. TITLE		20. DATE
21. ACCEPTED BY (Signature)	22. TITLE	23. DATE	24. PROPERTY VOUCHER NO.

NASA FORM 1046 AUG 97 PREVIOUS EDITIONS ARE OBSOLETE.

Figure C.8-a NASA Form 1046, Transfer and/or Notification of Acceptance of Accountability of Real Property

C.8 NASA Form 1046 (Back of Form), Transfer and/or Notification of Acceptance of Accountability of Real Property



25. CONSTRUCTION DEFICIENCIES

26. EXPLANATORY NOTES *(Continue on Separate Sheet)*

INSTRUCTIONS

The page number and the total number of pages comprising each transaction shall be shown in the space provided at the top right-hand part of the form.

ITEM 1. - Self-explanatory.

ITEM 2. - DATE. Enter date of preparation.

ITEM 3. - JOB NO. Enter NASA job number, if applicable.

ITEM 4. - CONTRACT NO. Enter NASA contract number, if applicable.

ITEM 5. - PROJECT NO. Enter the number assigned to identify the project with appropriate construction or capital improvement.

ITEM 6. - Self-explanatory.

ITEM 7. - TYPE OF TRANSACTION. Enter an "x" in the appropriate box in block 7a to indicate whether the transfer and/or notification of acceptance of accountability covers new construction, existing facilities or capital improvements to existing facilities. If the "other" category is used, explain in item 26, "Explanatory Notes." In addition, insert an "x" in the appropriate box of block 7b to indicate whether acceptance is being made at time of beneficial occupancy, physical completion or financial completion *(with respect to new construction and capital improvements)*. If the "other" category is used, explain in item 26, "Explanatory Notes."

ITEM 8. - ITEM NO. Each single entry will be identified as an item number, and this item number will be shown in this column.

ITEM 9. - FACILITY CLASSIFICATION CODE. Enter the applicable classification code as cited in the Manual.

ITEM 10. - FACILITY DESCRIPTION. Enter the descriptive nomenclature of the facility.

ITEM 11. - NO. OF UNITS. Enter the number of units in terms of buildings or other structures.

ITEM 12. - TYPE. Enter the type of construction, i.e., "P" for permanent, "S" for semi-permanent or "T" for temporary.

ITEM 13. - UNIT OF MEASURE. Enter as appropriate "SF" for square feet, or "Acres," etc.

ITEM 14. - TOTAL QUANTITY. Enter the total quantity applicable *(i.e., acres, square feet, etc.)* for the line item.

ITEM 15. - COST. - Indicate by item number and description the appropriate cost. In these instances where a document is prepared which lists items carrying costs which in some cases may be final, and in others may be preliminary, each cost figure by line item will carry an alphabetical suffix of "P" for preliminary or "F" for final.

ITEMS 16 & 17. - Self-explanatory.

ITEMS 18, 19, & 20. Enter the signature and title of the person preparing the transaction and the date.

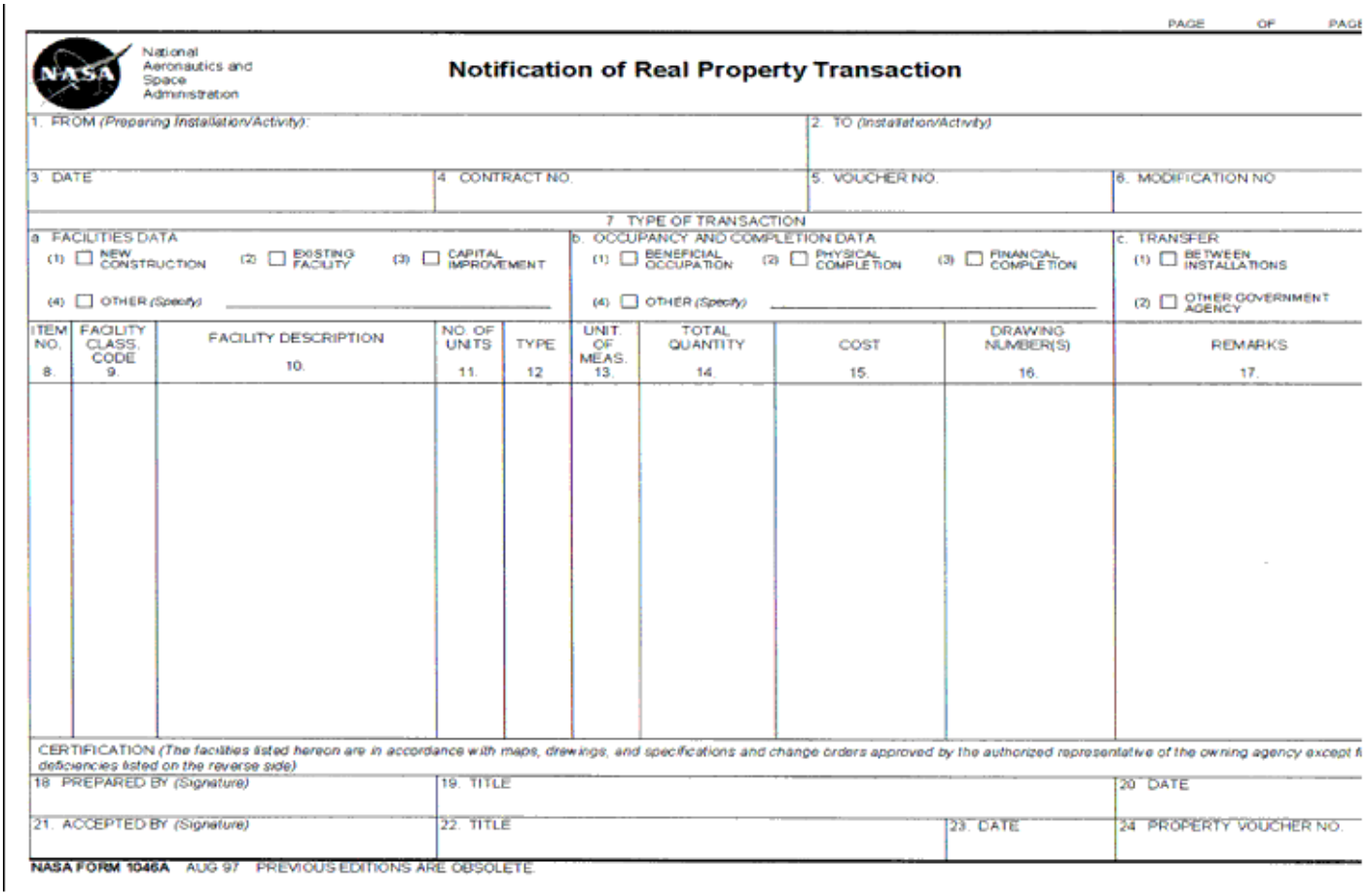
ITEMS 21, 22, 23, & 24. Enter the signature and title of the person authorized to accept accountability of the real property, including date and voucher number.

ITEMS 25 & 26. Self-explanatory.

NASA FORM 1046 AUG 97 PREVIOUS EDITIONS ARE OBSOLETE.

Figure C.8-b NASA Form 1046, Transfer and/or Notification of Acceptance of Accountability of Real Property (Back of Form)

C.9 NASA Form 1046A, Notification Real Property Transfer



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Notification of Real Property Transaction

1. FROM *(Preparing Installation/Activity)*:

2. TO *(Installation/Activity)*

3. DATE

4. CONTRACT NO.

5. VOUCHER NO.

6. MODIFICATION NO.

7. TYPE OF TRANSACTION

a. FACILITIES DATA
(1) ☐ NEW CONSTRUCTION (2) ☐ EXISTING FACILITY (3) ☐ CAPITAL IMPROVEMENT
(4) ☐ OTHER *(Specify)*

b. OCCUPANCY AND COMPLETION DATA
(1) ☐ BENEFICIAL OCCUPATION (2) ☐ PHYSICAL COMPLETION (3) ☐ FINANCIAL COMPLETION
(4) ☐ OTHER *(Specify)*

c. TRANSFER
(1) ☐ BETWEEN INSTALLATIONS
(2) ☐ OTHER GOVERNMENT AGENCY

ITEM NO. 8.	FACILITY CLASS. CODE 9.	FACILITY DESCRIPTION 10.	NO. OF UNITS 11.	TYPE 12.	UNIT OF MEAS. 13.	TOTAL QUANTITY 14.	COST 15.	DRAWING NUMBER(S) 16.	REMARKS 17.

CERTIFICATION *(The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the owning agency except f deficiencies listed on the reverse side)*

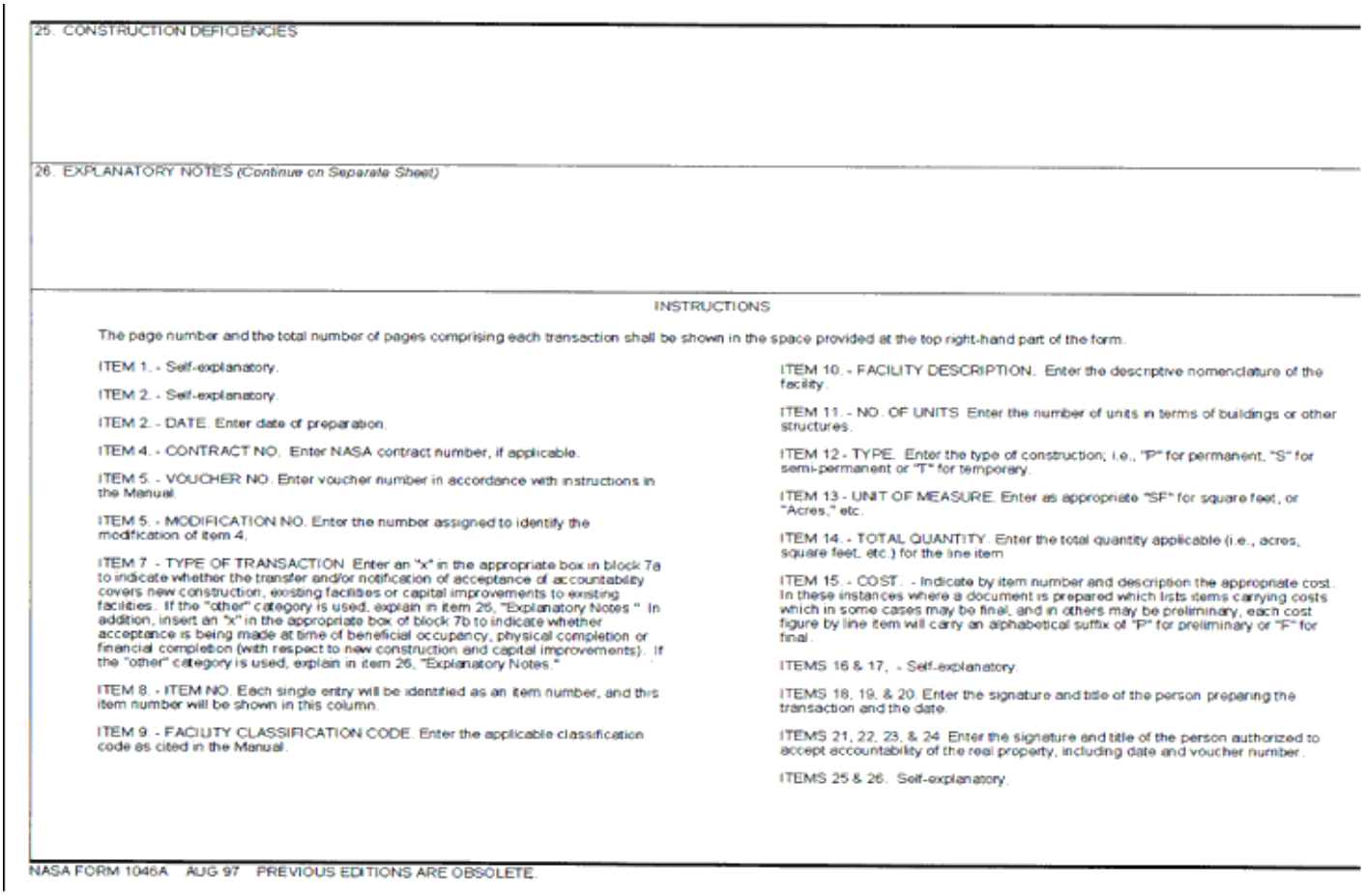
18. PREPARED BY *(Signature)* | 19. TITLE | 20. DATE

21. ACCEPTED BY *(Signature)* | 22. TITLE | 23. DATE | 24. PROPERTY VOUCHER NO.

NASA FORM 1046A AUG 97 PREVIOUS EDITIONS ARE OBSOLETE

Figure C.9-a NASA Form 1046A, 1046A, Notification Real Property Transfer

C.9 NASA Form 1046A (Back of Form), 1046A, Notification Real Property Transfer



25. CONSTRUCTION DEFICIENCIES

26. EXPLANATORY NOTES *(Continue on Separate Sheet)*

INSTRUCTIONS

The page number and the total number of pages comprising each transaction shall be shown in the space provided at the top right-hand part of the form.

ITEM 1. - Self-explanatory.

ITEM 2. - Self-explanatory.

ITEM 2. - DATE. Enter date of preparation.

ITEM 4. - CONTRACT NO. Enter NASA contract number, if applicable.

ITEM 5. - VOUCHER NO. Enter voucher number in accordance with instructions in the Manual.

ITEM 5. - MODIFICATION NO. Enter the number assigned to identify the modification of item 4.

ITEM 7. - TYPE OF TRANSACTION. Enter an "x" in the appropriate box in block 7a to indicate whether the transfer and/or notification of acceptance of accountability covers new construction, existing facilities or capital improvements to existing facilities. If the "other" category is used, explain in item 26, "Explanatory Notes." In addition, insert an "x" in the appropriate box of block 7b to indicate whether acceptance is being made at time of beneficial occupancy, physical completion or financial completion (with respect to new construction and capital improvements). If the "other" category is used, explain in item 26, "Explanatory Notes."

ITEM 8. - ITEM NO. Each single entry will be identified as an item number, and this item number will be shown in this column.

ITEM 9. - FACILITY CLASSIFICATION CODE. Enter the applicable classification code as cited in the Manual.

ITEM 10. - FACILITY DESCRIPTION. Enter the descriptive nomenclature of the facility.

ITEM 11. - NO. OF UNITS. Enter the number of units in terms of buildings or other structures.

ITEM 12 - TYPE. Enter the type of construction; i.e., "P" for permanent, "S" for semi-permanent or "T" for temporary.

ITEM 13 - UNIT OF MEASURE. Enter as appropriate "SF" for square feet, or "Acres," etc.

ITEM 14. - TOTAL QUANTITY. Enter the total quantity applicable (i.e., acres, square feet, etc.) for the line item.

ITEM 15. - COST. - Indicate by item number and description the appropriate cost. In these instances where a document is prepared which lists items carrying costs which in some cases may be final, and in others may be preliminary, each cost figure by line item will carry an alphabetical suffix of "P" for preliminary or "F" for final.

ITEMS 16 & 17. - Self-explanatory.

ITEMS 18, 19, & 20. Enter the signature and title of the person preparing the transaction and the date.

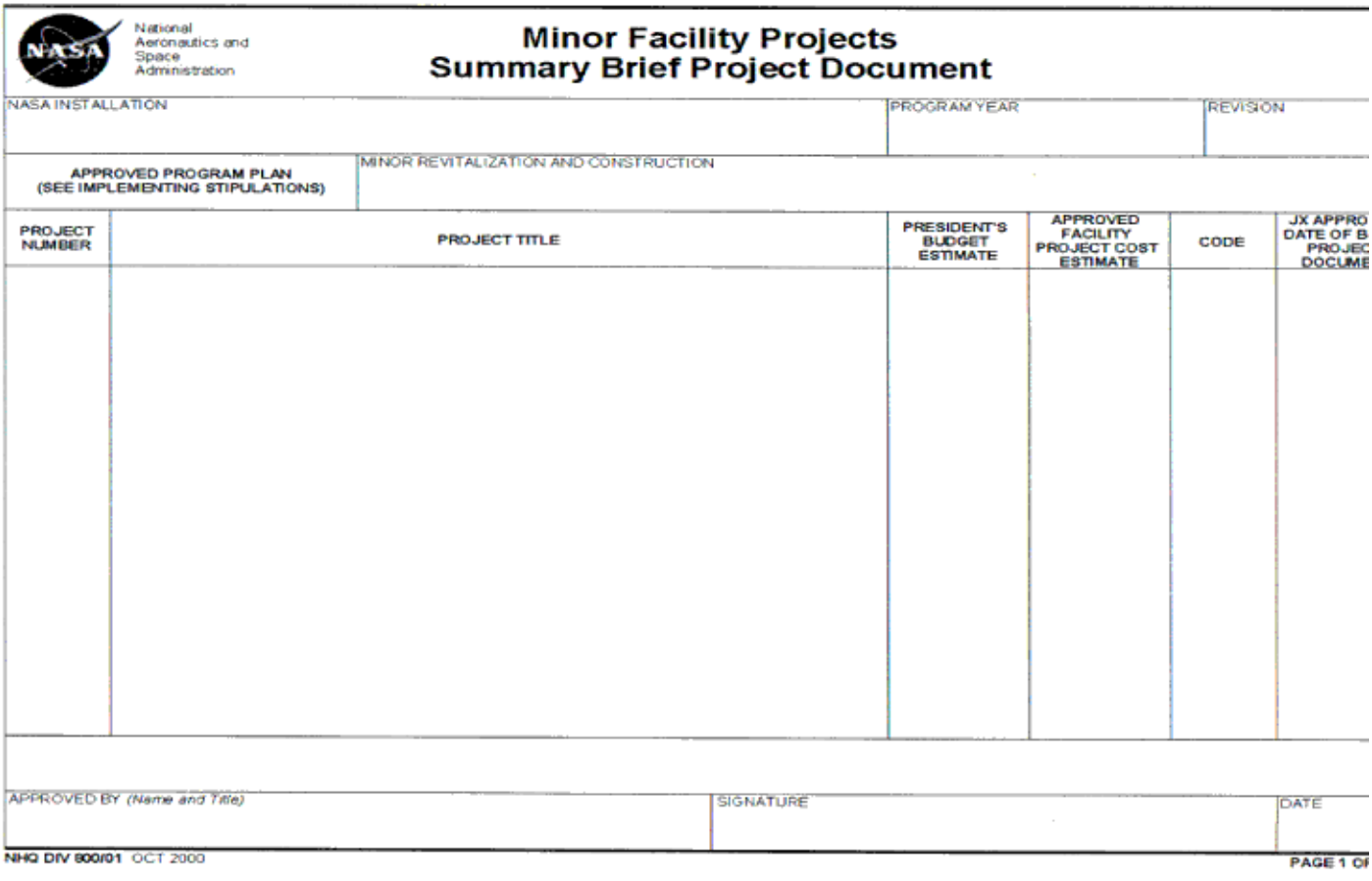
ITEMS 21, 22, 23, & 24. Enter the signature and title of the person authorized to accept accountability of the real property, including date and voucher number.

ITEMS 25 & 26. Self-explanatory.

NASA FORM 1046A AUG 97 PREVIOUS EDITIONS ARE OBSOLETE.

Figure C.9-b NASA Form 1046A, 1046A, Notification Real Property Transfer (Back of Form)

C.10 NASA Minor Facility Projects - Summary Brief Project Document



National Aeronautics and Space Administration

Minor Facility Projects
Summary Brief Project Document

NASA INSTALLATION	PROGRAM YEAR	REVISION

APPROVED PROGRAM PLAN (SEE IMPLEMENTING STIPULATIONS)	MINOR REVITALIZATION AND CONSTRUCTION

PROJECT NUMBER	PROJECT TITLE	PRESIDENT'S BUDGET ESTIMATE	APPROVED FACILITY PROJECT COST ESTIMATE	CODE	JX APPRO DATE OF B PROJEC DOCUME

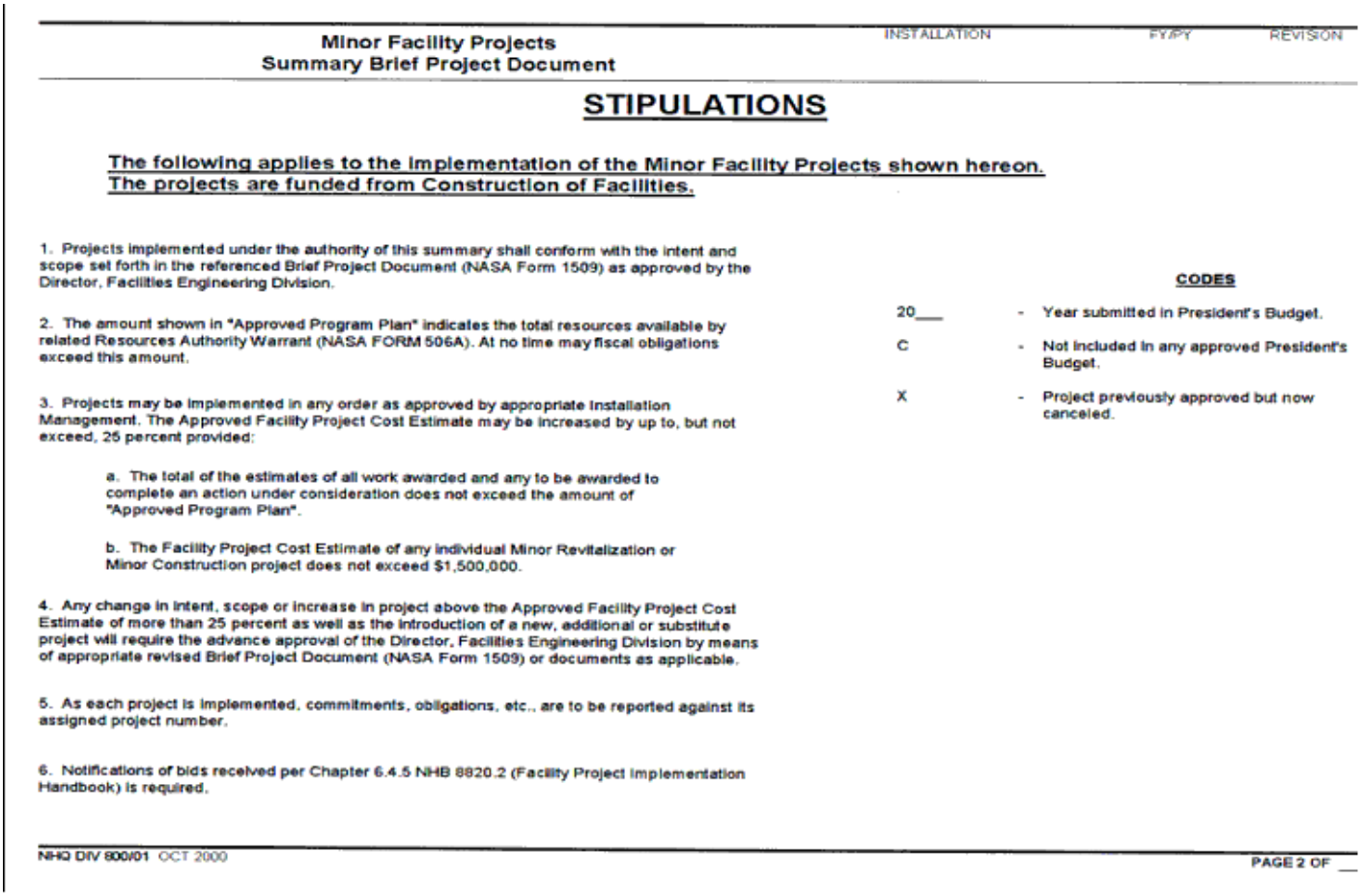
APPROVED BY *(Name and Title)*	SIGNATURE	DATE

NHQ DIV 800/01 OCT 2000 PAGE 1 OF

Figure C.10-a NASA Minor Facility Projects - Summary Brief Project Document

C.10 NASA Minor Facility Projects - Summary Brief Project Document Stipulations

.



Minor Facility Projects
Summary Brief Project Document

INSTALLATION | FY/PY | REVISION

STIPULATIONS

The following applies to the implementation of the Minor Facility Projects shown hereon. The projects are funded from Construction of Facilities.

1. Projects implemented under the authority of this summary shall conform with the intent and scope set forth in the referenced Brief Project Document (NASA Form 1509) as approved by the Director, Facilities Engineering Division.

2. The amount shown in "Approved Program Plan" indicates the total resources available by related Resources Authority Warrant (NASA FORM 506A). At no time may fiscal obligations exceed this amount.

3. Projects may be implemented in any order as approved by appropriate Installation Management. The Approved Facility Project Cost Estimate may be increased by up to, but not exceed, 25 percent provided:

   a. The total of the estimates of all work awarded and any to be awarded to complete an action under consideration does not exceed the amount of "Approved Program Plan".

   b. The Facility Project Cost Estimate of any individual Minor Revitalization or Minor Construction project does not exceed $1,500,000.

4. Any change in intent, scope or increase in project above the Approved Facility Project Cost Estimate of more than 25 percent as well as the introduction of a new, additional or substitute project will require the advance approval of the Director, Facilities Engineering Division by means of appropriate revised Brief Project Document (NASA Form 1509) or documents as applicable.

5. As each project is implemented, commitments, obligations, etc., are to be reported against its assigned project number.

6. Notifications of bids received per Chapter 6.4.5 NHB 8820.2 (Facility Project Implementation Handbook) is required.

CODES

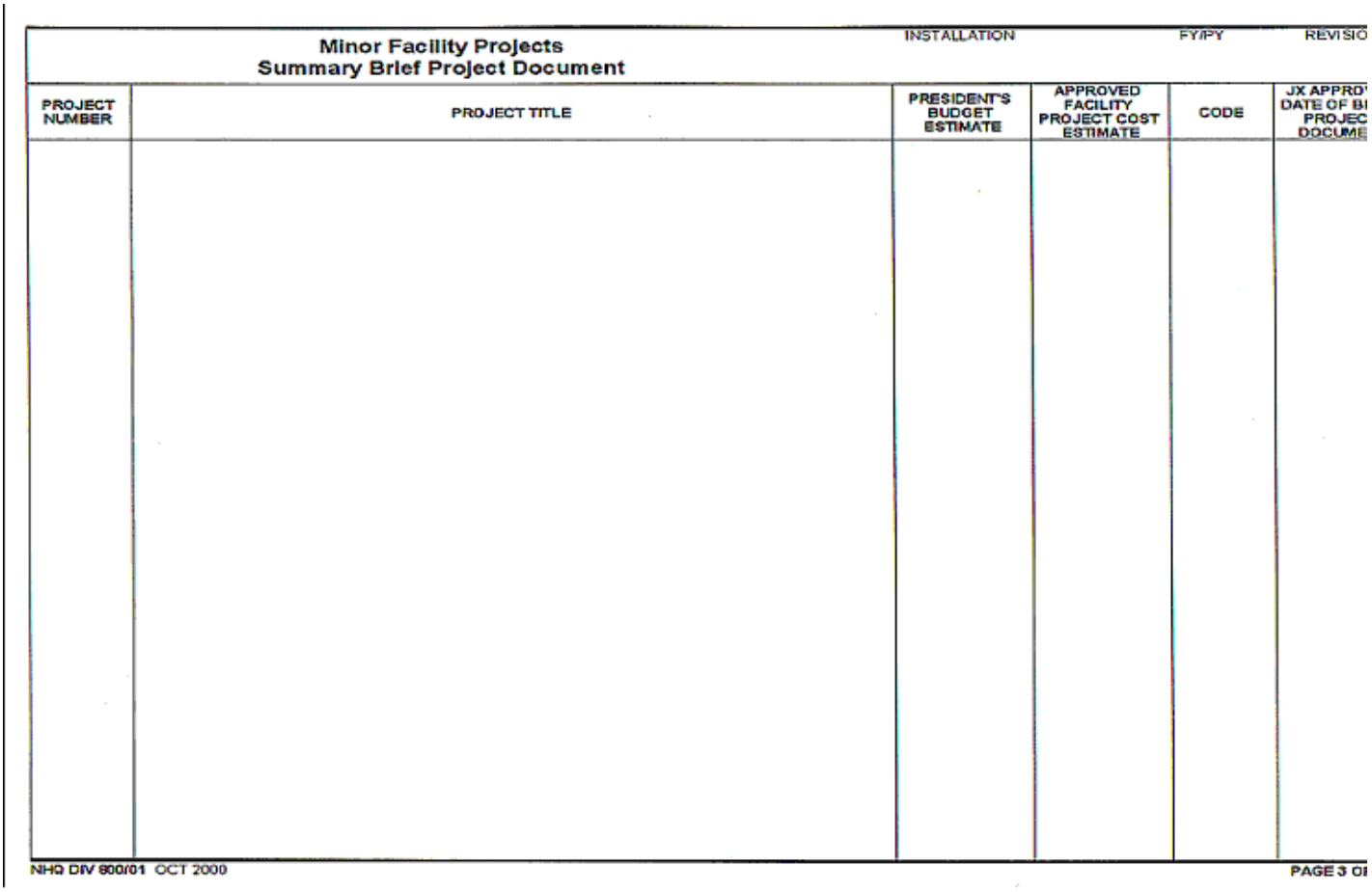
20___	-	Year submitted in President's Budget.
C	-	Not included in any approved President's Budget.
X	-	Project previously approved but now canceled.

NHQ DIV 800/01 OCT 2000

PAGE 2 OF __

Figure C.10-b Minor Facility Projects - Summary Brief Project Document Stipulations

C.10 NASA Minor Facility Projects - Summary Brief Project Document (Continuation)



Minor Facility Projects
Summary Brief Project Document

INSTALLATION

FY/PY

REVISIO

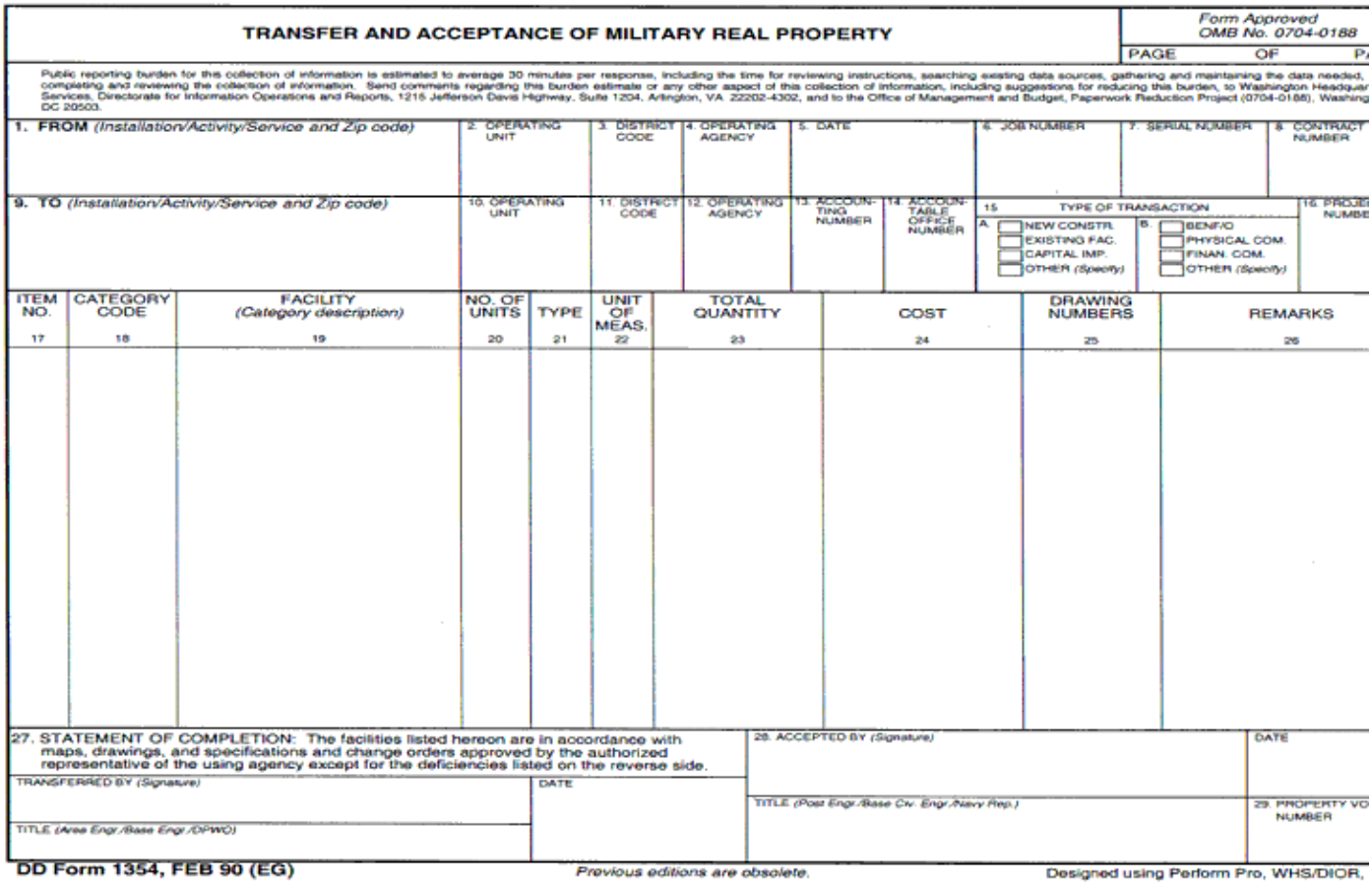
PROJECT NUMBER	PROJECT TITLE	PRESIDENT'S BUDGET ESTIMATE	APPROVED FACILITY PROJECT COST ESTIMATE	CODE	JX APPRO DATE OF BI PROJEC DOCUME

NHQ DIV 800/01 OCT 2000

PAGE 3 O

Figure C.10-c Minor Facility Projects - Summary Brief Project Document (Continuation)

C.11 DD Form 1354, Transfer and Acceptance of Millitary Real Property (Link to DOD Site for Form 1354, http://web1.whs.osd.mil/forms/DD1354.PDF



TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY

Form Approved OMB No. 0704-0188

PAGE OF P

Public reporting burden for this collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquar Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washing DC 20503.

1. FROM *(Installation/Activity/Service and Zip code)*	2. OPERATING UNIT	3. DISTRICT CODE	4. OPERATING AGENCY	5. DATE	6. JOB NUMBER	7. SERIAL NUMBER	8. CONTRACT NUMBER
9. TO *(Installation/Activity/Service and Zip code)*	10. OPERATING UNIT	11. DISTRICT CODE	12. OPERATING AGENCY	13. ACCOUNTING NUMBER	14. ACCOUNTABLE OFFICE NUMBER	15. TYPE OF TRANSACTION A. ☐ NEW CONSTR. ☐ EXISTING FAC. ☐ CAPITAL IMP. ☐ OTHER *(Specify)* B. ☐ BENFO ☐ PHYSICAL COM. ☐ FINAN. COM. ☐ OTHER *(Specify)*	16. PROJE NUMBE

ITEM NO. 17	CATEGORY CODE 18	FACILITY *(Category description)* 19	NO. OF UNITS 20	TYPE 21	UNIT OF MEAS. 22	TOTAL QUANTITY 23	COST 24	DRAWING NUMBERS 25	REMARKS 26

27. STATEMENT OF COMPLETION: The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the using agency except for the deficiencies listed on the reverse side.

TRANSFERRED BY *(Signature)* — DATE

TITLE *(Area Engr./Base Engr./DPWO)*

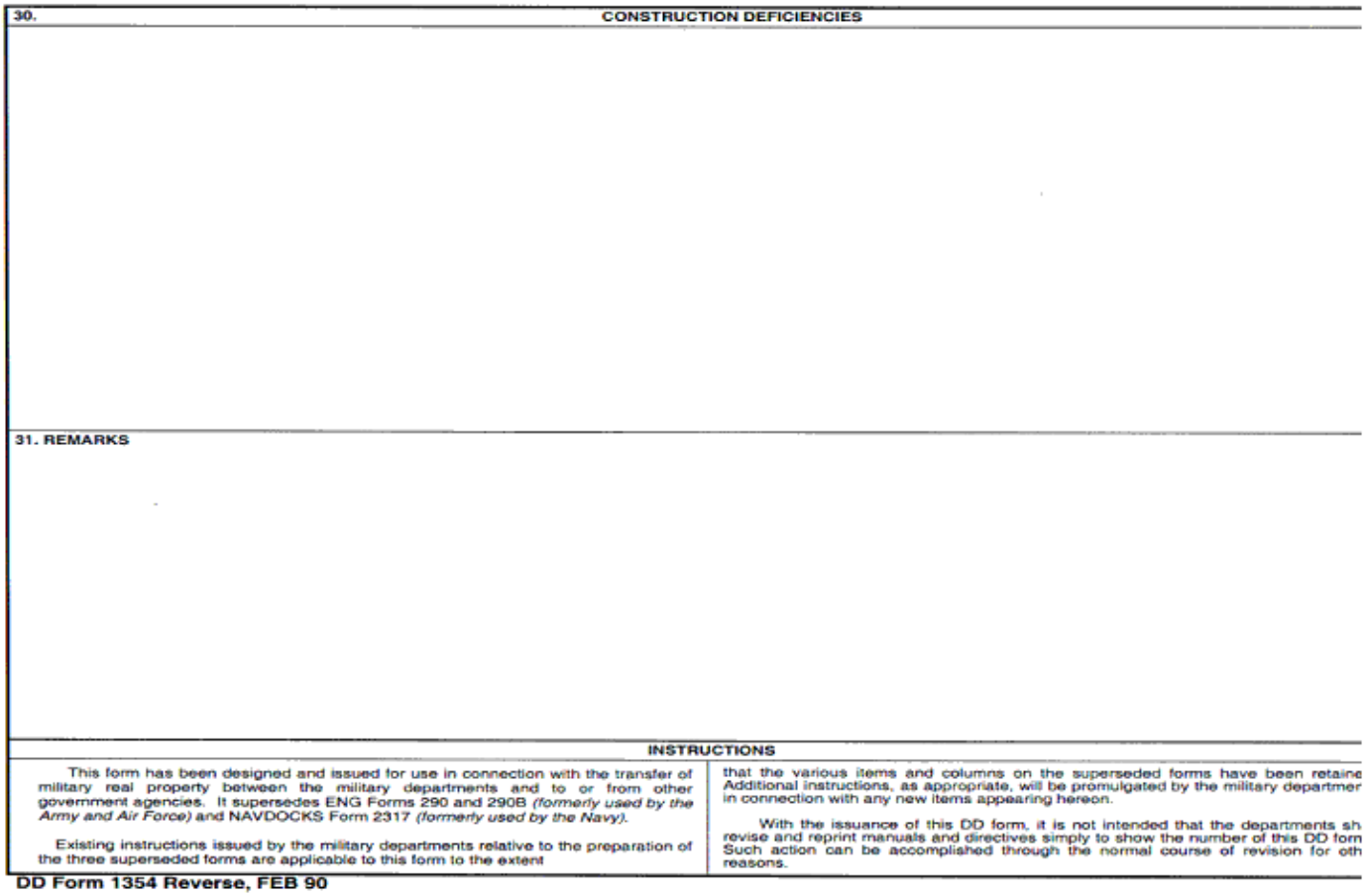
28. ACCEPTED BY *(Signature)* — DATE

TITLE *(Post Engr./Base Civ. Engr./Navy Rep.)* — 29. PROPERTY VO NUMBER

DD Form 1354, FEB 90 (EG) *Previous editions are obsolete.* Designed using Perform Pro, WHS/DIOR,

Figure C.11-a DD Form 1354, Transfer and Acceptance of Millitary Real Property

C.11 DD Form 1354 (Continuation), Construction Deficiencies



30. CONSTRUCTION DEFICIENCIES

31. REMARKS

INSTRUCTIONS

This form has been designed and issued for use in connection with the transfer of military real property between the military departments and to or from other government agencies. It supersedes ENG Forms 290 and 290B *(formerly used by the Army and Air Force)* and NAVDOCKS Form 2317 *(formerly used by the Navy)*.

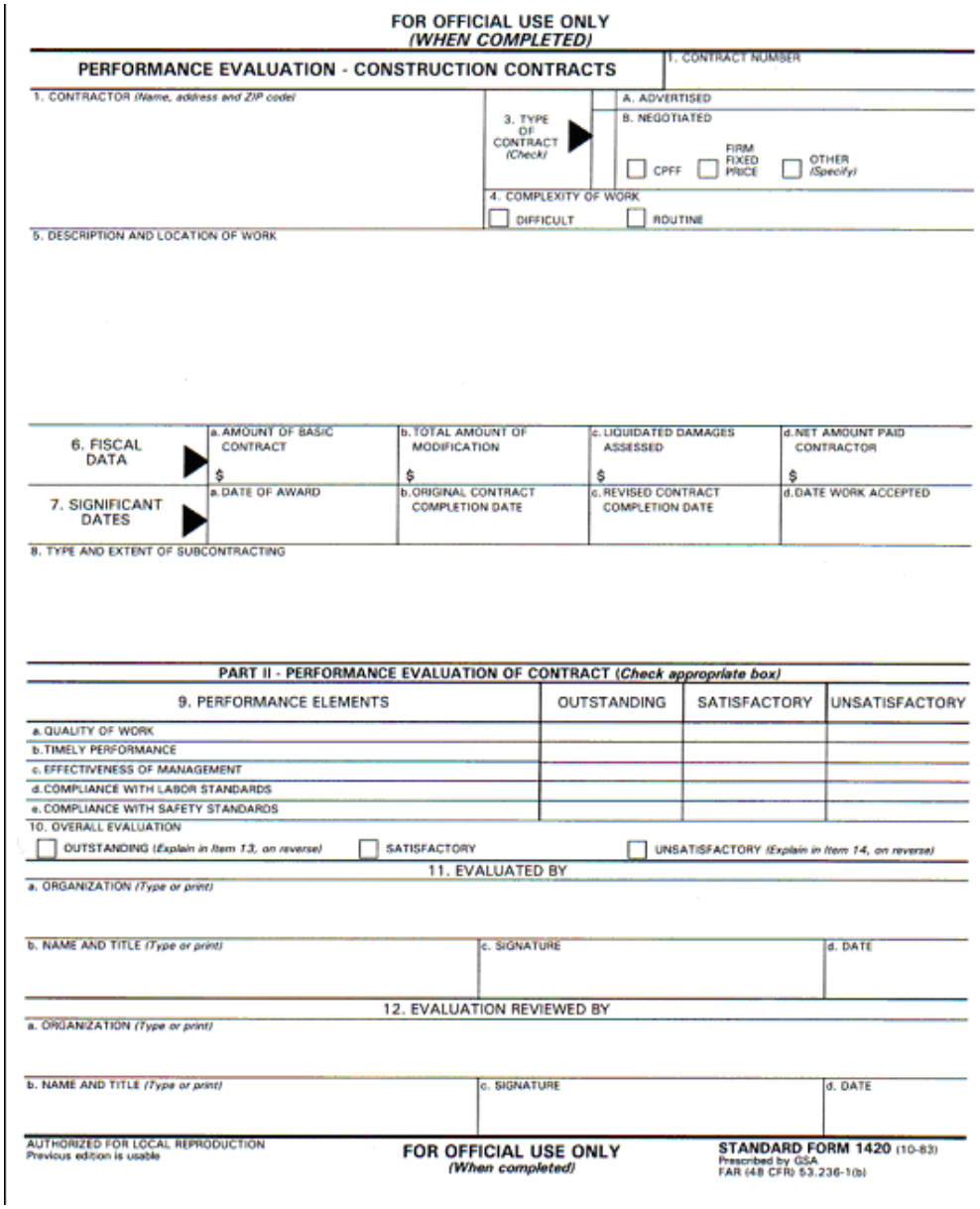
Existing instructions issued by the military departments relative to the preparation of the three superseded forms are applicable to this form to the extent that the various items and columns on the superseded forms have been retaine Additional instructions, as appropriate, will be promulgated by the military departmer in connection with any new items appearing hereon.

With the issuance of this DD form, it is not intended that the departments sh revise and reprint manuals and directives simply to show the number of this DD form Such action can be accomplished through the normal course of revision for oth reasons.

DD Form 1354 Reverse, FEB 90

Figure C.11-b DD Form 1354, Transfer and Acceptance of Millitary Real Property (Continuation)

C.12 Standard Form 1420, Performance Evaluation - Construction Contracts



FOR OFFICIAL USE ONLY
(WHEN COMPLETED)

PERFORMANCE EVALUATION - CONSTRUCTION CONTRACTS

1. CONTRACT NUMBER

1. CONTRACTOR *(Name, address and ZIP code)*

3. TYPE OF CONTRACT *(Check)*
- A. ADVERTISED
- B. NEGOTIATED
  - CPFF
  - FIRM FIXED PRICE
  - OTHER *(Specify)*

4. COMPLEXITY OF WORK
- DIFFICULT
- ROUTINE

5. DESCRIPTION AND LOCATION OF WORK

	a. AMOUNT OF BASIC CONTRACT	b. TOTAL AMOUNT OF MODIFICATION	c. LIQUIDATED DAMAGES ASSESSED	d. NET AMOUNT PAID CONTRACTOR
6. FISCAL DATA	$	$	$	$
7. SIGNIFICANT DATES	a. DATE OF AWARD	b. ORIGINAL CONTRACT COMPLETION DATE	c. REVISED CONTRACT COMPLETION DATE	d. DATE WORK ACCEPTED

8. TYPE AND EXTENT OF SUBCONTRACTING

PART II - PERFORMANCE EVALUATION OF CONTRACT *(Check appropriate box)*

9. PERFORMANCE ELEMENTS	OUTSTANDING	SATISFACTORY	UNSATISFACTORY
a. QUALITY OF WORK			
b. TIMELY PERFORMANCE			
c. EFFECTIVENESS OF MANAGEMENT			
d. COMPLIANCE WITH LABOR STANDARDS			
e. COMPLIANCE WITH SAFETY STANDARDS			

10. OVERALL EVALUATION
- OUTSTANDING *(Explain in Item 13, on reverse)*
- SATISFACTORY
- UNSATISFACTORY *(Explain in Item 14, on reverse)*

11. EVALUATED BY

a. ORGANIZATION *(Type or print)*

b. NAME AND TITLE *(Type or print)*	c. SIGNATURE	d. DATE

12. EVALUATION REVIEWED BY

a. ORGANIZATION *(Type or print)*

b. NAME AND TITLE *(Type or print)*	c. SIGNATURE	d. DATE

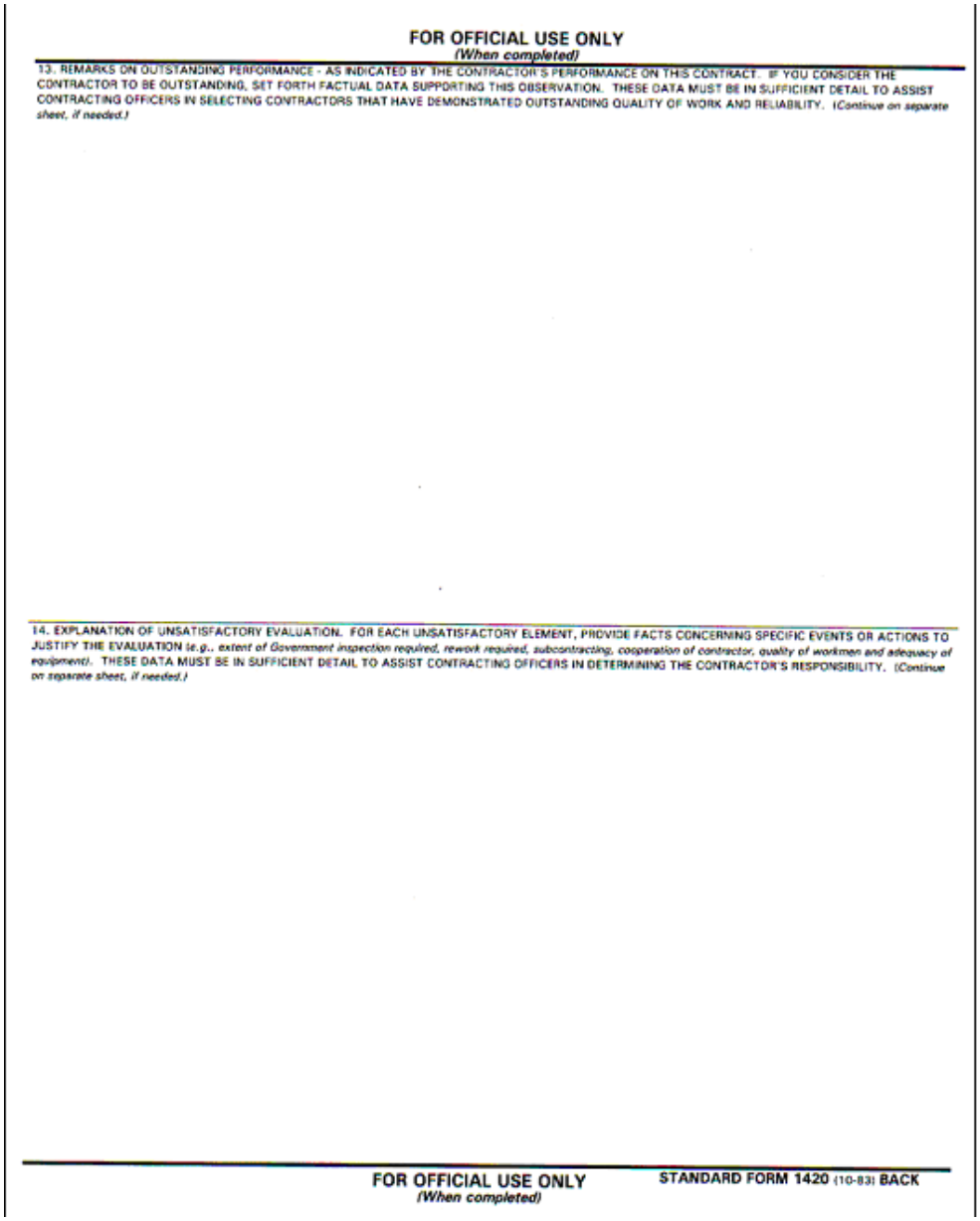
AUTHORIZED FOR LOCAL REPRODUCTION
Previous edition is usable

FOR OFFICIAL USE ONLY
(When completed)

STANDARD FORM 1420 (10-83)
Prescribed by GSA
FAR (48 CFR) 53.236-1(b)

Figure C.12-a Standard Form 1420, Performance Evaluation - Construction Contracts

C.12 Standard Form 1420 (Continuation), Performance Evaluation - Construction Contracts



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(When completed)

13. REMARKS ON OUTSTANDING PERFORMANCE - AS INDICATED BY THE CONTRACTOR'S PERFORMANCE ON THIS CONTRACT. IF YOU CONSIDER THE CONTRACTOR TO BE OUTSTANDING, SET FORTH FACTUAL DATA SUPPORTING THIS OBSERVATION. THESE DATA MUST BE IN SUFFICIENT DETAIL TO ASSIST CONTRACTING OFFICERS IN SELECTING CONTRACTORS THAT HAVE DEMONSTRATED OUTSTANDING QUALITY OF WORK AND RELIABILITY. *(Continue on separate sheet, if needed.)*

14. EXPLANATION OF UNSATISFACTORY EVALUATION. FOR EACH UNSATISFACTORY ELEMENT, PROVIDE FACTS CONCERNING SPECIFIC EVENTS OR ACTIONS TO JUSTIFY THE EVALUATION *(e.g., extent of Government inspection required, rework required, subcontracting, cooperation of contractor, quality of workmen and adequacy of equipment).* THESE DATA MUST BE IN SUFFICIENT DETAIL TO ASSIST CONTRACTING OFFICERS IN DETERMINING THE CONTRACTOR'S RESPONSIBILITY. *(Continue on separate sheet, if needed.)*

FOR OFFICIAL USE ONLY
(When completed)

STANDARD FORM 1420 (10-83) BACK

Figure C.12-b Standard Form 1420, Performance Evaluation - Construction Contracts (Continuation)

POP 2002 Worksheet 1 for Construction of Facilities: COF DETAILED BUDGET SUBMISSION ($000) 4/25/02

CENTER: **XXX**

Institutional (Mission Support):	FY 04	FY 05	FY 06	FY 07	FY 08
	_____ Cost	_____ Cost	_____ Cost	_____ Cost	_____ Cost
	Title	Title	Title	Title	Title

a. Discrete (projects over $1.5M)	Upgrade Electric Propulsion Research Building, Phase 1 (16)	4,600	Upgrade Electric Propulsion Research Building, Phase 2 (16)	4,400	Repair Roofs and Masonry, Various Buildings	4,800	Rehab of Development Engineering Building (500)	3,000	Replace 34.5 kV Transformers at Sub J & M	4,60(
	Repair Roofs and Masonry, Various Buildings	1,600	Rehab HVAC System, Ad Bldg. (3)	4,600	Repair Parking Lots and Roads	3,200	Repair Building Foundations & Drianage	2,500	Replace 34.5 kV Transformers at Sub J & M	3,40(
	Replace Turboexpanders	2,700					Repair Parking Lots & Roads	2,500		
	Total	**8,900**		**9,000**		**8,000**		**8,000**		**8,0(**
b. Minor Program Projects (projects $0.5M to $1.5M)	Rehab & Mod of model Fabrication & Instrument Facility	1,100	Repair High Voltage Switchgear	900	Lump Sum	**7,000**	Lump Sum	**8,000**		
	Repair High Voltage System, Plum Brook	1,200	Rehab Mechanical Systems, CAEB, Phaze 1 (64)	1,200						
	Rehab of OMPVE Crystal Growth Fac	1,100								
	Total	**3,400**		**2,100**						
c. Facility Planning & Design	Lump Sum	1,500	Lump Sum	1,600	Lump Sum	1,600	Lump Sum	1,600	Lump Sum	1,60(
	Grand Total	**13,800**	**Grand Total**	**12,700**	**Grand Total**	**16,600**	**Grand Total**	**17,600**	**Grand Total**	**17,6(**

Program Direct:	FY 04		FY 05	FY 06	FY 07	FY 08
	Title	Cost ($000)				
a. Discrete (projects over $1.5M)	N/A				N/A	N/A
b. Minor Program Projects (projects $0.5M to $1.5M) (Revitalization and Minor Construction)			N/A	N/A	N/A	N/A

c. Facility Planning & Design	N/A	N/A	N/A	N/A	N/A
	Grand Total	**0**	**0**	**0**	**0**

POP 02 Worksheet 2 for CoF: COF FY 2004 INTEGRATED INSTITUTIONAL PROJECT SUMMARY

CENTER: **XXX**

Integrated Priority List of Discrete and Minor Institutional Projects

FY04 Title	(E) Construction Cost ($000)
Upgrade Electric Propulsion Research Building, Phase 1 (16)	4,600
Repair Roofs and Masonry, Various Buidings	1,600
Replace Turboexpanders (124)	2,700
Rehab & mod of Model Fabrication & Instrument Facility, Phase 4 (14)	1,100
Repair High Voltage System, Plum Brook	1,200
Rehab of OMPVE Crystal Grows Facility (302)	1,100
CoF Program Total	12,300

Figure C.15, Example - POP 5-Year Plan Submittal

APPENDIX D: Facility and Other Related Costs

D.1 Typical Facility Cost. The current cost estimate (CCE) included on Form 1510 and 1509 for a typical facility project includes the current local cost of the following:

a. Land acquisition,

b. Site preparation, utilities, sidewalks, and/or access roads,

c. Construction materials and labor,

d. Material and equipment tests performed at the construction site or at an offsite location,

e. Construction management services including network diagrams,

f. Environmental protection,

g. Collateral equipment,

h. Subcontractor and general contractor cost, overhead and profit, and

i. General conditions, bonds, and taxes.

D.2 Related Costs. The following is a partial list of items that are normally funded from other than facilities resources and should not be included in the engineering estimate and therefore are not in the project cost estimate. However, the Director, Facilities Engineering Division, can make an exception on a case-by-case basis. Any related cost items should be included in the Related Cost Data section of Form 1510 and the Related Costs Involved section of Form 1509.

a. Planning/studies documentation such as the following:

(1) Environmental Assessments (EA) and Environmental Impact Statements (EIS),

(2) Permit actions (e.g., environmental, storm water, dredging) unless directly related to the construction contracting effort,

(3) Pre-PER studies (i.e., concept studies and/or requirements document),

(4) Planning studies, and

(5) Design related activities other than SIES such as the following:

(i) Independent design analysis,

(ii) Third-party review,

(iii) Safety analysis,

(iv) Engineering support,

(v) Reliability and quality assurance support,

(vi) Software quality assurance support,

(vii) Program scheduling, and

(viii) Documentation and control.

b. Outfitting items such as the following:

(1) Noncollateral equipment such as the following:

(i) Research, checkout, and assembly hardware/equipment,

(ii) Test support and ground support equipment,

(iii) Cleaning/precleaning equipment, and

(iv) Furniture.

(2) Telephones, modems, switching equipment, and associated wiring (see Note 1),

(3) Communications equipment (voice/data) and associated wiring (see Note 1),

(4) Electronic security systems hardware (see Note 1),

(5) Paging and area warning systems hardware (see Note 1),

(6) Process/support equipment (see Note 1),

(7) Carpet and installation (initial carpet or carpet tile installation when used as the primary floor covering can be included in the CCE),

(8) Window and door treatments (e.g., blinds, glare controls, drapes, except where blinds are an integral part of the window or door unit, then the initial purchase can be included in the CCE),

(9) Lockers unless built-in and substantially affixed,

(10) Clocks,

(11) Video equipment,

(12) Computer hardware, and

(13) Automatic data processing equipment (including cables, fiber optics, and network connections).

c. Services such as the following:

(1) Building/vehicle maintenance,

(2) Janitorial services,

(3) Storage costs for noncollateral equipment,

(4) Security personnel,

(5) Spare parts,

(6) Warranties (except when associated with equipment or structural members that are an integral part of the facility),

(7) Operator certification and training programs,

(8) Operational readiness reviews, and

(9) Integrated systems testing and safety reviews.

d. Others such as the following:

(1) Relocation/move in expenses,

(2) Acquisition process,

(3) Temporary housing,

(4) Costs of utility consumption,

(5) Facility calibration,

(6) Facility dedication,

(7) Personnel travel, and

(8) Training (beyond the scope of installed collateral equipment).

Note 1: In general, items such as conduits, raceways, cable trays, ductwork, wall penetrations, terminal rooms, junction and terminal boxes, which are permanently affixed, are included in the CCE of the facility project.

APPENDIX E: NASA and Other Government Directives/Publications

E.1 NASA Agencywide Directives, Guidelines and Standards

NASA Policy Directives (NPDs) and NASA Procedures and Guidelines (NPGs) are available in NODIS.

NASA-STD 8719.7, Facility System Safety Guidebook.

NASA-STD 8719.11, Safety Standard for Fire Protection.

E.2 Other Government Publications

NBS Handbook 135, Life-Cycle costing Manual for the Federal Energy Management Programs.

OMB Circular A-11, Preparation and Submission of Budget Estimates.

OMB Circular A-34, Instructions on Budget Execution.

OMB Circular A-94 (for hyperlink see paragraph 3.16), Discount Rates to be Used in Evaluating Time Distributed Costs and Benefits.

OMB Circular A-131, Value Engineering.

OMB Circular A-109, Major Systems Acquisitions. (Available in hard copy only)

U.S. Department of Labor, Davis-Bacon Act wage determinations

APPENDIX F: Legislative Acts for Project Implementation

F.1 Americans With Disabilities Act (ADA) of 1990

On July 26, 1990, the Americans with Disabilities Act (ADA) became law. The Act outlaws discrimination on the basis of race, religion, sex, national origin, and disability. The ADA provides protection against discrimination in jobs, services, and accommodations for individuals with disabilities. NASA complies with ADA through the Rehabilitation Act of l973. It removed the emphasis on vocational rehabilitation and focused on total rehabilitation of all people with disabilities. The three sections of the Rehabilitation Act of 1973, as amended, that cover NASA are:

a. Section 501 that requires Federal agencies in the executive branch of Government to develop an affirmative action program for hiring, placement, and advancement of people with disabilities.

b. Section 504 that prohibits discrimination on the basis of disability in federally assisted programs and activities.

c. Section 508 that requires that electronic and information technology be accessible to people with disabilities, including employees and members of the public.

F.2 Health and Safety Policies and Procedures

F.2.1 Several Federal regulations related to safety and health impact directly upon building and construction functions of NASA and the Federal Government. The following are notable regulations:

a. Executive Order 12196 - Occupational safety and health programs for Federal employees, as amended.

b. 29 CFR Part 1910 OSHA general industry requirements including requirements for some building features.

c. 29 CFR Part 1926 OSHA construction requirements applicable to all Federal and contractor construction workers including fall protection, public protection, trenching, and scaffolding.

d. Public Law 100678 (Public Buildings Amendments of 1988) requires that buildings constructed or altered by Federal agencies comply with one of the nationally recognized model building codes and zoning laws.

F.2.1.2 In addition, NASA Headquarters or the Installations may specify compliance with other codes and standards as required.

F.3 Metrication

The Metric Conversion Act of 1975, as amended by the Omnibus Trade and Competitiveness Act of 1988 (15 U.S.C., 205a, et seq.) designates the metric system of measurement as the preferred system of weights and measures for United States trade and commerce except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms. Requiring activities are responsible for establishing appropriate units of measure for projects. Executive Order 12770 implements the Act and requires agency plans. NASA NPD 8010.2D, Use of the Metric System of Measurement in NASA Programs, governs metrication.

F.4 Procurement Policies and Procedures

F.4.1 Policies and procedures pertinent to contracting for construction and architect-engineer services are prescribed by Part 36 of the Federal Acquisition Regulations (FAR) and Part 1836 of the NASA FAR Supplement (NFS).

Construction and architect-engineer contracts are also subject to other parts of these regulations. The FAR provides implementation guidance and procedures resulting from laws, executive orders, and regulations. Examples are:

F.4.2 Brooks Act (41 U.S.C. 254(b)) refers to the Act, which established quality-based versus price-based selection of AE firms. It further set the AE fee-for-services for public works or utilities (contract price or cost and fee) for production and delivery of designs, plans, drawings, and specifications at 6 percent of the estimated cost of construction of the public work or utility, excluding fees (see FAR 15.404-4).

F.4.3 Buy American Act (41 U.S.C. 10 and Executive Order 10582, December 17, 1954, as amended) requires, with limited exceptions, the use of domestic construction materials. Domestic construction materials means (a) an unmanufactured construction material mined or produced in the United States; or (b), a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50-percent of the cost of all of its components (see FAR 25.2).

F.4.4 Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333) -requires that laborers or mechanics be paid an overtime rate of not less than 1 1/2 times their basic rate of pay when required to work more than 40 hours in any work week (see FAR 22.3).

F.4.5 Copeland (AntiKickback) Act (18 U.S.C. 874 and 40 U.S.C. 276c) makes it unlawful to induce by force, intimidation, or threat of dismissal from employment, any person employed in the construction or repair of public buildings or public works financed in whole or part by the United States, to give up any part of the compensation to which that person is entitled under a contract of employment. The Act also requires the contractor and subcontractors to furnish a weekly statement of compliance with the "Anti-Kickback" statute and any related Department of Labor regulations (see FAR 22.4).

F.4.6 Davis Bacon Act (40 U.S.C. 276a7) provides that contractors awarded contracts in excess of $2,000 for construction, alteration, or repair of public buildings, or public works within the United States, shall pay laborers and mechanics employed directly on the site not less than the prevailing wage rates as determined by the Secretary of Labor.

F.4.7 Miller Act (40 U.S.C. 270a270f) requires performance and payment bonds for any construction contract exceeding $100,000 except when waived. Performance bonds are a guarantee of completion of the work. Payment bonds protect suppliers of material and labor (see FAR 28.1). Alternative payment protection for construction contracts greater than $25,000, but not more than $100,000 is required in accordance with Section 4101(b)(2) of the Federal Acquisition Streamlining Act of 1994 (P.L. 103-355).

F.4.8 Procurement Integrity Act (41 U.S.C. 423, as amended, Section 27) prohibits, during the conduct of a procurement, Government employees and/or representatives of competing contractors who function as procurement officials from engaging in discussion of future employment or business opportunity, offering or accepting gratuities or things of value, or soliciting, offering or otherwise disclosing proprietary or source selection information. Certain postemployment restrictions apply to Government employees (see FAR 3.104).

F.4.9 This listing is not inclusive and is a small portion of the laws, Executive orders, and regulations, which are imposed by other parts of the FAR.

APPENDIX G: Sustainability

G.1 NASA's Facilities Program

G.1.1 Background. The NASA vision and missions suggest it must have a facilities infrastructure that is effective, efficient, safe, secure, and environmentally friendly, and a staff of facility professionals who are inspired, prepared, and capable of performing to the highest possible standards of their profession. Successful accomplishment of NASA missions requires all of its employees and contractors to constantly work at the cutting edge of their profession.

G.1.1.1 The cutting edge of today's facilities engineering profession is heavily focused upon improving the ultimate performance of capital plant projects. Areas receiving particular attention include the following:

a. Improving worker productivity resulting from improved building environmental ambiance and architectural aesthetics in a safe, secure, and more accessible workplace,

b. Minimizing a facility's impact upon the environment as a result of its construction, operation and ultimate decommissioning,

c. Improving facility performance in terms of energy efficiency, ease of maintenance, and improved facility system reliability, availability, operability, and durability,

d. Ensuring that projects ultimately perform to their design goals and objectives, and

e. Increasing emphasis upon facility life-cycle cost rather than first cost.

G.1.1.2 In 2002, facilities in the United States consumed 40 percent of the Nation's energy, 25-percent of harvested forests, and 17 percent of potable water produced. They generated 50-percent of chlorofluorocarbon emissions, 40 percent of landfill content, and 33 percent of carbon dioxide emissions. In 2002, NASA's infrastructure included over 5,000 facilities with about 44 million square feet on 400,000 acres of land. Annually, that infrastructure consumes nearly 10,000 billion British thermal units (BTU) of energy, and releases 270,000 tons of carbon emissions. Constrained budgets for operations and maintenance exceed $200 million annually.

G.1.1.3 This appendix introduces NASA facility professionals, and all others involved in the facility acquisition process, to the concept of sustainability, which encompasses industry practices of sustainable design, maintainable design, and building commissioning, and the important facility aspects of safety and security. The appendix provides a roadmap to enable facility professionals to plan, design, construct, activate, and maintain facility projects that: operate as intended; are maintainable at least cost and in a time sensitive manner; consume minimal energy and resources; and provide a safe, comfortable, secure and productive environment for NASA's research, test, production, institutional and administrative programs.

G.1.2 Section Content

G.1.2.1 Sustainability Concepts. Section 2 describes the concepts associated with sustainability, including subsections on the following:

a. Sustainability definitions,

b. Sustainability requirements and mandates,

c. The business case for implementing sustainability in NASA facilities,

d. Challenges to successfully implementing sustainability,

e. Existing NASA best practices, and

f. The sustainability team, process, and tools.

G.1.2.2 Sustainability and Project Planning. Section 3 includes the following subsections that describe how to apply sustainability concepts during the project planning phase of a facility acquisition:

a. An overview of the planning phase,

b. General sustainability issues to consider during the planning phase, and

c. Sustainability action items during the planning phases.

G.1.2.3 Sustainability and Project Design. Section 4 describes applicability of sustainability concepts to the project design phase, including subsections on the following:

a. An overview of the design phase,

b. General sustainability issues to consider during the design phase, and

c. Sustainability action items during the design phase.

G.1.2.4 Sustainability and Project Construction. The following subsections included in Section 5 describe applicability of sustainability concepts during the project construction phase:

a. An overview of the construction phase,

b. General sustainability issues to consider during the construction phase, and

c. Sustainability action items during the construction phase.

G.1.2.5 Sustainability and Project Activation. Section 6 describes applicability of sustainability concepts during the project activation phase, including subsections on the following:

a. An overview of the activation phase,

b. General sustainability issues to consider during the activation phase, and

c. Sustainability action items during the activation phase.

G.1.2.6 Sustainability during Operations and Maintenance. Section 7 describes the applicability of sustainability concepts after a facility has been accepted, and has moved into the operations and maintenance phase. Section 7 includes subsections on the following:

a. An overview of the operations and maintenance phase,

b. General sustainability issues to consider during the operations and maintenance phase, and

c. Sustainability action items during the operations and maintenance phase.

G.1.2.7 Sustainability During Facility Decommissioning. Section 8 describes the applicability of sustainability concepts at the end of a facilities life cycle. This period is referred to as the decommissioning phase. Section 8 includes sections on the following:

a. An overview of the decommissioning phase,

b. General sustainability issues to consider during the decommissioning phase, and

c. Sustainability action items during the decommissioning phase.

G.2 Sustainability Concepts

G.2.1 Definitions. Sustainability is not a new idea. Historically, Master Builders worked from a life-cycle perspective while operating in harmony with the landscape, the local climate, and the buildings of their neighbors. They made use of natural, locally available materials that were non-toxic to humans. They have long applied sustainable principles to their building designs and demonstrated their efficacy. The following definition for sustainability allows NASA facility managers to address all three emerging practices (sustainable design, maintainable design and building commissioning, and appropriate safety and security issues) in one concept. The definition promotes integrating these concepts on all NASA facility projects.

G.2.1.1 Sustainability. An overarching concept incorporating appropriate sustainable design practices, maintainable design elements, building commissioning processes, and safety and security features into facility planning, design, construction, activation, operation and maintenance, and decommissioning to enhance and balance facility life-cycle cost, environmental impact, and occupant health, safety, security, and productivity. Done properly, sustainability will optimize the facility acquisition process to ensure the "best fit" of the built environment to the natural environment. It requires a practical and balanced approach to responsible stewardship of our natural, human, and financial resources.

G.2.1.2 Sustainable Design. A practice that involves planning, designing, constructing, activating, and operating buildings to reduce the negative impact on the environment, minimize energy consumption, and promote the productivity, health, and comfort of building occupants. The fundamental principles of sustainable design are the following:

a. Optimizing site potential,

b. Protecting and conserving water,

c. Minimizing energy use,

d. Using environmentally preferable products,

e. Enhancing Indoor Environmental Quality (IEQ), and

f. Optimizing operational and maintenance practices.

G.2.1.3 Maintainable Design. A practice that emphasizes the integration of operations and maintenance experience and principles into project planning, design and construction processes to achieve ease, accuracy, safety, and economy of maintenance tasks throughout the life of a facility. Maintainable design results in a facility that is durable, reliable, accessible, and operable. The following are fundamental principles of maintainable design:

a. Promoting participation and incorporating input by the O&M staff throughout the acquisition process,

b. Optimizing operation and maintenance practices and philosophy (using a combination of reactive, preventive, predictive and proactive maintenance strategies),

c. Emphasizing safety, accessibility, and ergonomics,

d. Minimizing the complexity and difficulty of maintenance tasks,

e. Using standard, interchangeable, and/or modular components, and

f. Measuring, trending and analyzing O&M performance, monitoring progress, and developing lessons learned throughout the facility life.

G.2.1.4 Building Commissioning. A quality process emphasizing procedures to ensure that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the owner's project requirements. The process begins during project planning and extends through design, construction, activation, and operations and maintenance. Building commissioning concepts can be applied throughout the life of the facility. The fundamental principles of building commissioning are the following:

a. Identifying and documenting the functional requirements (user defined), facility requirements (as developed by the project team), and the basis and intent of the design,

b. Establishing processes to verify that project requirements are achieved; using a commissioning plan; using a commissioning authority; and including commissioning requirements in construction contracts,

c. Using functional performance testing and predictive technologies to ensure proper facility operation and to identify and eliminate latent defects prior to accepting new facilities or equipment by incorporating all the elements of NASA's RCBEA program, and

d. Measuring and documenting performance results throughout the acquisition process to ensure the project requirements are met.

G.2.1.5 Facility Safety and Security. Ensure project decisions include appropriate features to safeguard the health and welfare of facility visitors, occupants and equipment against internal hazards or external dangers (due to facility siting or terrorist activities). Safety and security issues must be considered during all phases of the facility acquisition process, and for the entire facility life-cycle.

G.2.2 Federal Mandates. This subsection addresses the primary laws, regulations and policies that require Federal Agency action regarding sustainability.

G.2.2.1 The primary Federal mandate for sustainability is Executive Order (EO) 13123, Greening the Government Through Efficient Energy Management, dated June 3, 1999, is the primary order driving Federal agencies to develop sustainable design capability. Section 403(d) of EO 13123 requires Federal agencies to apply sustainable design principles to the "...siting, design, and construction of new facilities." The Department of Defense (DOD), the General Services Administration (GSA), the Department of Energy (DOE) and the Environmental Protection Agency (EPA) were tasked with developing the sustainable design principles. EO 13123 further requires agencies to "...optimize life-cycle costs, pollution, and other environmental and energy costs associated with the construction, life-cycle operation, and decommissioning..." of facilities. The order requires agencies to reduce energy consumption compared to 1985 and 1990 usage levels. Agencies were encouraged to meet the Energy Star building criteria for energy performance and indoor environmental quality by 2002.

G.2.2.2 Many other mandates require some aspects of sustainability on Federal facilities project, including:

a. The National Environmental Policy Act (NEPA) of 1969, which indirectly requires Federal facility managers to consider sustainability principals for construction projects.

b. Executive Order 12852 (EO 12852, 1993) established The President's Council on Sustainable Development (PCSD), a presidential advisory committee which adopted the following definition for sustainable from the World Commission on Environment and Development, Our Common Future: "...using resources today to meet the needs of the present without compromising the ability of future generations to meet their own needs."

c. Executive Order 12977 (EO 12977, 1995) created the Interagency Security Committee (ISC), headed by the Administrator of the General Services Administration, tasked with evaluating security standards for Federal facilities.

d. Executive Order 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisitions, dated September 14, 1998, requires Federal agencies to consider: using recovered materials; recycling; waste prevention and reduction; pollution prevention; and life-cycle costing in its daily practices. The order directed the EPA to develop a Comprehensive Procurement Guideline to make it easier for Federal agencies to identify and use environmentally friendly products. EO 13101 required Federal agencies to establish short- and long term goals for recycling or solid waste prevention.

e. Executive Order 13148, (EO 13148), Greening the Government Through Leadership in Environmental Management requires agencies to promote the sustainable management of Federal lands through cost-effective, environmentally sound landscaping practices, and other programs to reduce adverse impacts to the natural environment.

f. In response to the Energy Policy Act of 1992, the Department of Energy's Federal Energy Management Program (FEMP), in cooperation with The General Services Administration, developed the Building Commissioning Guide.

G.2.2.3 In 1994, the National Science and Technology Council of the Construction Building Subcommittee developed and published seven overarching National Construction Goals. These goals, to have been achieved by 2003, relate directly to sustainability concepts. The goals include the following:

a. Reduce project delivery time by 50-percent,

b. Reduce O&M and energy costs by 50-percent,

c. Increase occupant productivity and comfort by 50-percent,

d. Reduce occupant related illnesses by 50-percent,

e. Reduce waste and pollution by 50-percent,

f. Increase the durability and flexibility of facilities by 50-percent, and

g. Reduce construction illnesses and injuries by 50-percent.

G.2.3 NASA Mandates. NASA has several implementing policies and guidelines to ensure compliance with the Federal mandates. Two important NASA Procedural Requirements (NPRs) include NPR 8570.1, Energy Efficiency and Water Conservation Technologies and Practices and NPR 8820.3, Pollution Prevention . Specific sustainability requirements outlined in these two documents include the following:

a. Reduce overall energy use per gross square foot in nonmission variable buildings/facilities by 30-percent by FY 2005, and 35 percent by FY 2010, relative to FY 1985 levels.

b. Improve the energy efficiency of energy-intensive buildings/facilities (e.g. laboratories) 20 percent by FY 2005 and 25-percent by FY 2010, relative to FY 1990 levels.

c. Expand the use of renewable energy for facilities and operational activities by implementing renewable energy projects and by purchasing electricity from clean, efficient, and renewable energy sources so that the equivalent of 2-1/2 percent of facility electricity comes from new renewable sources by FY 2005 (1990 baseline).

d. Reduce greenhouse gas emissions attributed to facility energy use by 30-percent by FY 2010, compared to such emission levels in FY 1990.

e. Reduce the use of petroleum in facility operations by switching to a less greenhouse gas-intensive, nonpetroleum-based energy source where practical and cost effective and by otherwise improving the efficiency with which petroleum is used. EO 13149 sets a separate goal for motor vehicles - 20 percent reduction by FY 2005 from 1999 baseline.

f. Reduce water consumption and associated energy use by implementing appropriate Best Management Practices (BMP) identified by the DOE.

g. Reduce source energy even if site energy increases.

h. Comply with or exceed 10 CFR 434 Federal Energy Performance Standards for new construction.

i. Meet or exceed American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE)/ Illuminating Engineering Society of North America (IESNA) Standard 90.1-1999

j. Use ASHRAE Standard 55-1992, Thermal Environmental Conditions for Human Occupancy (1992) as the basis for thermal comfort. This standard sets forth temperature controls within facilities used for various applications.

k. Meet or exceed ASHRAE Standard 62-1999, Ventilation for Acceptable Indoor Air Quality, which establishes the minimum acceptable ventilation requirements.

l. This appendix will help project managers develop project specific goals that will contribute to meeting or exceeding the Agencywide goals listed above.

G.2.4. The Business Case for Implementing Sustainability in NASA Facilities

G.2.4.1 Facility owner and occupant benefits from implementing sustainability for a typical project include:

a. Reduced energy and water consumption,

b. Reduced waste streams and air pollution,

c. Reduced requirements for supporting infrastructure,

d. Reduced new equipment failure due to latent defects,

e. Extended equipment life and enhanced reliability,

f. Improved facility system availability, flexibility, and performance,

g. Reduced operations, maintenance, and decommissioning costs,

h. Reduced absenteeism and improved employee morale and productivity, and

i. Community recognition.

G.2.4.2 Implementing sustainability makes good business sense for NASA. It improves the balance between cost, schedule, and performance that is the ultimate objective of sound engineering practice.

G.2.4.3 When considered in total, the overall costs for planning and designing a facility are a relatively minor portion (typically about 10-percent) of the project's first costs. When compared to the much larger total life-cycle cost of the facility, including the costs for operations, they are an even smaller percentage (less than 1 percent). The implication is that almost any activity during project planning and design that identifies and incorporates features to reduce the project's operations, maintenance, labor, and production expenses will be cost effective over the facility life cycle. Many industry examples support this theory; including Lockheed's sustainability designed Engineering Building in Sunnyvale, California realized a 50-percent reduction in energy consumption and a 15-percent increase in worker productivity.

G.2.4.4 Industry experience indicates that many sustainability concepts with the potential for significant life-cycle savings can be incorporated at no increase in project first costs. Typically first cost increases for projects incorporating significant sustainability features range between 3-5 percent. Regardless of the extent to which sustainability is applied, the additional investments are highly likely to produce life-cycle paybacks. Properly implementing sustainability concepts may also extend a facility's useful life, and reduce the final facility shutdown and decommissioning costs.

G.2.4.5 The savings from implementing sustainability concepts contain many subjective elements, including improved employee morale and effects of environmental improvements (higher productivity, less sick leave), making them difficult to quantify within a life-cycle analysis. Industry advocates estimate that the direct and indirect savings are several times greater than any additional first costs. The goal of sustainability is to implement the discipline during project planning, design, construction, and activation, that will exploit every opportunity to reduce project life-cycle costs while enhancing the projects environmental impact and overall maintainability, safety, and productivity.

G.2.5 Challenges to Successful Implementation.

NASA Policy Document 8820.3 establishes sustainability as an Agency objective for all new projects. This policy mandates Centers to implement sustainability concepts on future projects.

G.2.5.1 A significant challenge to successfully and routinely implementing sustainability concepts on NASA facility projects is overcoming the tendency for decision makers to focus on first costs instead of life-cycle costs. Although many sustainability concepts can be implemented without increasing first project costs, some do require an additional initial investment. The existing Federal facilities project acquisition process devotes a significant amount of attention on project first costs. Funding for project design and construction is managed separately from funding for operations and maintenance. This funding structure creates incentives to lower first costs, freeing up funding for additional design and construction projects, or increases in specific project scopes.

G.2.5.2 Some people believe building commissioning would not be necessary if the owner hires qualified design professionals and skilled contractors who are responsible for delivering fully functional facilities. Several factors conspire to frustrate this reasonable expectation: increasingly complex and interdependent building technology, downward pressure on professional fees, highly competitive low-bid construction acquisition procedures, detachment of designer and builders from the realities of operating and maintaining facilities, inadequately defined owner project requirements, and lack of experience in demonstrating the functional integrity of components and systems under a full range of operating conditions. Therefore, for many projects commissioning is an appropriate process to ensure success.

G.2.5.3 Successfully and fully implementing sustainability concepts on projects requires a new mindset. Existing paradigms among project stakeholders must change. Early participation from all project stakeholders will be required. Use of emerging technologies must also be accepted, and guide specifications must be adjusted to incorporate changing materials and practices.

G.2.5.4 Many aspects of sustainable design practices, maintainable design elements, and building commissioning processes are applicable to renovation projects. Much less energy and resources are needed to produce construction materials and deliver them to the site when the building's basic shell is being reused. Older buildings, in particular, make excellent candidates for low-energy design that utilizes their mass, higher ceilings, and narrower building form. Project teams must deal with some fixed constraints in renovation projects, including the building's site, orientation, massing, and structural systems.

G.2.6 Existing NASA Best Practices. NASA Centers have successfully implemented practices of RCBEA, Preproject Planning, Constructability, Value Management, Partnering/Teambuilding. Sustainability is integrated into and fully supports the fundamental concepts of these best practices.

G.2.6.1 RCBEA focuses on using predictive technologies to identify latent defects in building systems and equipment prior to acceptance. Properly applied, RCBEA reduces incidence of infant mortality, and ensures NASA obtains the full life and usefulness of installed equipment.

G.2.6.2 Preproject Planning (P3) is a powerful and methodical process to ensure project criteria, goals, and objectives are identified before design start. The P3 process also establishes the project team. Sustainability introduces some additional elements into the P3 process to achieve sustainability criteria, goals and objectives (such as building commissioning requirements, and increased emphasis on specific sustainable design, maintainable design and safety and security alternatives).

G.2.6.3 The process for evaluating Constructability has many similarities with maintainable design. Both processes ensure that design decisions that will impact subsequent facility life-cycle phases (i.e., cause undue construction, operations or maintenance problems) are not overlooked during project planning and design. Sustainability, and in

particular the maintainable design element, provides additional emphasis on the operations and maintenance aspects following construction completion.

G.2.6.4 Value Management involves seeking opportunities to improve project cost, schedule, or performance features. Sustainability will enhance the value management approach, by providing significantly increased emphasis on life-cycle considerations, and ensuring that all project alternatives and competing interests are addressed during the development of the owner's project requirements.

G.2.6.5 Partnering and Teambuilding focuses on effectively involving a wide range of project stakeholders to ensure project success. Sustainability also advocates wide participation to ensure that all stakeholders have an opportunity to contribute to project requirements and objectives. The team approach forces informed decisions and compromises that are in the best long-term interest of the overall organization.

G.2.6.6 NASA's progressive operations and maintenance programs include Reliability Centered Maintenance (RCM). The RCM approach and using predictive technologies for building and equipment acceptance follow principles found in the maintainable design and building commissioning practices. NASA's energy and environmental programs are also very proactive and have achieved significant success.

G.2.6.7 NASA's Reliability Centered Building and Equipment Acceptance program emphasizes the use of predictive technologies and inspections to identify latent defects during the construction and activation phases of a project. This approach is reinforced by the sustainability concepts included in this appendix, including the building commissioning and maintainable design elements.

G.2.6.8 The material in this guideline acknowledges these ongoing programs, and where appropriate, acknowledges the interface and integration with them.

G.2.7 The Sustainability Team.

G.2.7.1 Successfully implementing sustainability requires teamwork. The team, organized and working together from the project inception, must integrate sustainable design concepts in the planning and design process, seeking creative solutions to design challenges that yield multiple benefits. Rather than optimizing individual systems, the project team must understand that the most effective results are obtained by designing various building systems and components as interdependent parts of the entire structure.

G.2.7.2 FPIG Section 3.4 discusses Preproject Planning and the team concept. A successful project team for sustainability complements the Preproject Planning process, and should include the following members:

a. Facility Project Manager, to provide overall leadership that ensures that competing interests are properly balanced and ultimately achieved.

b. Sustainability Champion, who understands sustainability principles and concepts, and how to successfully integrate them into the project.

c. Center Planning Staff, to provide guidance regarding broad goals and objectives for facility development.

d. Architects, Engineers and Designers, including in-house and contractor members to develop the plans and pecifications.

e. Contracting Representative, to advise on acquisition related issues.

f. Construction Manager, to advise on constructability related issues.

g. Operations and Maintenance Personnel, to address long-term operations and maintenance requirements for the facility and to share and capture maintenance lessons learned.

h. Safety and Security Representatives, to ensure appropriate measures are taken to safeguard people and property.

i. Environmental and Energy Managers, to help identify targets for energy and environmental consumption, and to ensure projects support meeting or exceeding mandates for their programs.

j. Customer, to identify final operating objectives. Ideally, the customer representative has long-term responsibility for O&M and program requirements. In the NASA environment, this is often not the case.

k. Commissioning Authority (CA), to ensure that operation of the final constructed facility meets the owner's project requirements. The CA is involved from planning through design, construction, and activation.

G.2.8 The NASA Sustainability Practice.

G.2.8.1 The extent to which sustainability should be pursued on a project depends upon the individual project's size, mission criticality, location, complexity, and available funding. This appendix suggests actions throughout the planning, design, construction and activation phases to ensure that the facility requirements are met. The NASA sustainability practice is intended to produce healthy debates and appropriate tradeoffs between competing requirements (i.e., should the facility have operable windows (sustainable design attribute), small fixed windows (a maintainability feature), or no windows (a security consideration)?).

G.2.8.2 The NASA sustainability practice parallels the building commissioning practice. Building commissioning is aimed at ensuring that the owners project requirements are achieved during the planning, design, construction and acceptance phases. Traditionally, building commissioning has focused upon testing, acceptance, and final operability of a constructed facility. The NASA sustainability practice includes other facility performance criteria, including criteria for sustainable design, maintainable design, safety and security. The practice reinforces the NASA RCBEA practice of using predictive technologies to identify and eliminate latent defects from facilities or equipment installation projects.

G.2.8.3 NASA Centers must submit an annual report of their progress toward implementing the policies described in NPD 8820.2, Design and Construction of Facilities. These annual reports will require Centers to focus on their level of commitment to sustainability principles, and report specific metrics related to that program. The annual reporting requirements will evolve, but are initially established to include the following:

a. Projects

(1) Percentage of A-E contracts awarded requiring sustainability experience as an evaluation factor in contract award,

(2) Number of construction projects using an independent commissioning agent, and

(3) The number of design and/or construction projects with sustainability achievements or elements.

b. Training

(1) Number of Center personnel that attended the NASA Sustainability Best Practices II course,

(2) Number of Center personnel that attended the NASA Reliability Centered Building & Equipment Acceptance course, and

(3) Number attending and description of any other Sustainability related training courses received.

G.2.9 Sustainability Tools. Many tools exist to help project managers understand and implement sustainability. The primary tools project teams should use include the following:

a. The Leadership in Energy and Environmental Design (LEED) rating system,

b. The Whole Building Design Guide (WBDG),

c. The Building for Environmental and Economic Sustainability (BEES) guideline,

d. The EPA and DOE's Energy Star© Program,

e. DOE's Energy 10 Program,

f. DOE's DOE-2 Energy Program,

g. The Construction Industry Institutes Design for Maintainability Guidebook (IR142-2),

h. The General Services Administration and Department of Energy's Building Commissioning Guide,

i. Model Commissioning Plan and Guide Specifications,

j. NASA's Reliability Centered Building & Equipment Acceptance Guide,

k. NASA NPG 8831.2D, Facilities Maintenance Management,

j. DOD Technical Manuals for Security Engineering, (TM 5-853-1 through 5-853-4), and

k. GSA Public Building System P-100, November 2000

G.2.9.1 All NASA projects will be evaluated for sustainability achievements using the LEED™ - Green Building

Rating Systemdeveloped by the U.S. Green Building Council (USGBC). LEED™ is a nationally recognized sustainable facility performance standard. Designed for rating new and existing commercial, institutional, and high-rise residential buildings, it is self-certifying. It is a feature-oriented system where credits are earned for many criteria, including: siting, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. The LEED system includes varying levels of certification, including Certified, Silver, Gold, and Platinum levels. The USGBC is piloting a version of LEED for existing buildings, which will allow ratings for renovation projects of existing facilities.

G.2.9.2 The WBDGis a comprehensive internet-based gateway to a wide range of Federal and private sector buildings-related guidance, criteria, and technology. The WBDG was developed by several Federal agencies in response to a mandate within Executive Order 13123. The WBDG links information across disciplines and traditional professional boundaries, and encourages integrated thinking and a whole building performance perspective. The recommendations within the WBDG will help improve the performance and quality of facility projects. The WBDG includes a significant listing of energy analysis tools useful for determining energy impacts of various design alternatives. The WBDG is hosted and managed by the National Institute of Building Sciences (NIBS).

G.2.9.3 The Building Environmental and Economic Sustainability software tool is a building materials analysis program developed by the National Institute of Standards and Technology (NIST). BEES measures the environmental performance of building products by using the environmental life-cycle assessment approach specified in ISO 14000 standards. All stages in the life of a product are analyzed: raw material acquisition, manufacture, transportation, installation, use, and recycling and waste management. Economic performance is measured using the ASTM standard life-cycle cost method, which covers the costs of initial investment, replacement, operation, maintenance and repair, and decommissioning. Environmental and economic performance is combined into an overall performance measure using the ASTM standard for Multi-Attribute Decision Analysis.

G.2.9.4 Energy Star© was introduced by the EPA in 1992 as a voluntary labeling program designed to identify and promote energy-efficient products to reduce carbon dioxide emissions. EPA partnered with DOE in 1996 to promote the Energy Star© label, with each agency taking responsibility for particular product categories, including residential heating and cooling equipment, major appliances, office equipment, lighting, and consumer electronics. Commercial and K-12 school buildings that are among the top 25-percent Nationwide in terms of energy performance (earning a benchmarking score of 75 or greater on a scale of 0 to 100) and maintain an indoor environment that conforms to industry standards can qualify to receive the Energy Star© label for buildings. During 2001, NASA qualified two of its facilities with the Energy Star© label.

G.2.9.5 DOE's ENERGY-10© is a software program designed for smaller residential or commercial buildings that can be treated as one or two-zone increments. It performs whole-building energy analysis for 8760 hours/year, including dynamic thermal and daylighting calculations, and is specifically designed to facilitate the evaluation of energy-efficient building features in the very early states of the design process.

G.2.9.6 DOE's DOE-2© is an hourly, whole-building energy analysis software program calculating energy performance and life-cycle cost of operation. It can be used to analyze energy efficiency of given designs or the energy efficiency of new technologies. Other uses include utility demand-side management and rebate programs, and development and implementation of energy efficiency standards and compliance certification.

G.2.9.7 The CII Design for Maintainability Guidebook IR 142-2 is a manual providing recommended practices and a variety of checklists, guidelines, and illustrative examples intended as implementation tools for achieving a high level of project maintainability. The research team responsible for this manual included NASA personnel, while the team documented and analyzed specific NASA projects at the Johnson Space Center. This resource includes a self-assessment that will define the organizational "level of maintainability"; describes a model implementation process; and provides specifics on more than 22 recommended maintainability practices and 16 tools to help implement these recommended practices. The CII education module presents maintainability concepts and practices described in the Design for Maintainability Guidebook.

G.2.9.8 The Building Commissioning Association's Building Commissioning Attributes is a short document that defines Essential Attributes and Valuable Elements of commissioning (http://www.bcxa.org/attributes.htm). The Building Commissioning Association (BCA) recommends that owners incorporate these attributes in their commissioning programs. Members of the BCA must agree to perform commissioning in accordance with the Essential Attributes to ensure the integrity and effectiveness of the commissioning process.

G.2.9.9 The General Services Administration and Department of Energy's Building Commissioning Guide and the companion Model Commissioning Plan and Guide Specifications provide a detailed discussion of how to implement the commissioning process on Federal projects. The Model Commissioning Plan and Guide Specifications include specific forms and procedures that may be adapted to the commissioning needs of a specific project.

G.2.9.10 NPR 8831.2D, Facilities Maintenance Management describes the practices and procedures Center's should be employing to ensure their operations and maintenance programs are effective. This NPG provides an excellent reference regarding O&M requirements that should be considered during project planning and design phases.

G.2.9.11 The NASA Reliability Centered Building & Equipment Acceptance Guide provides suggested contract language, test procedures, and test limits for using predictive technologies to identify latent defects in installed equipment. The project team should rely upon this resource to ensure appropriate testing is performed for critical equipment.

G.2.9.12 The Department of Defense Technical Manuals for Security Engineering, TM 5-853-1 through TM 5-853-4, May 1994 provides guidelines for designing federal facility projects in response to potential terrorist threats. The four manuals include considerations during the project planning (TM-5-853-1), concept design (TM 5-853-2), and final design (TM 5-853-3) phases, and also include planning and design requirements for electronic security systems (TM 5-853-4).

G.2.9.13 The GSA Public Building System P-100, November 2000.

G.2.10 The NASA Acquisition Process. The FPIG describes requirements for completing projects through the planning, design, construction and activation phases. This appendix in addition addresses requirements during the operations and maintenance and decommissioning phases. Figure G.2 identifies each acquisition phase. The significant steps in successfully implementing sustainability concepts are listed for each phase.

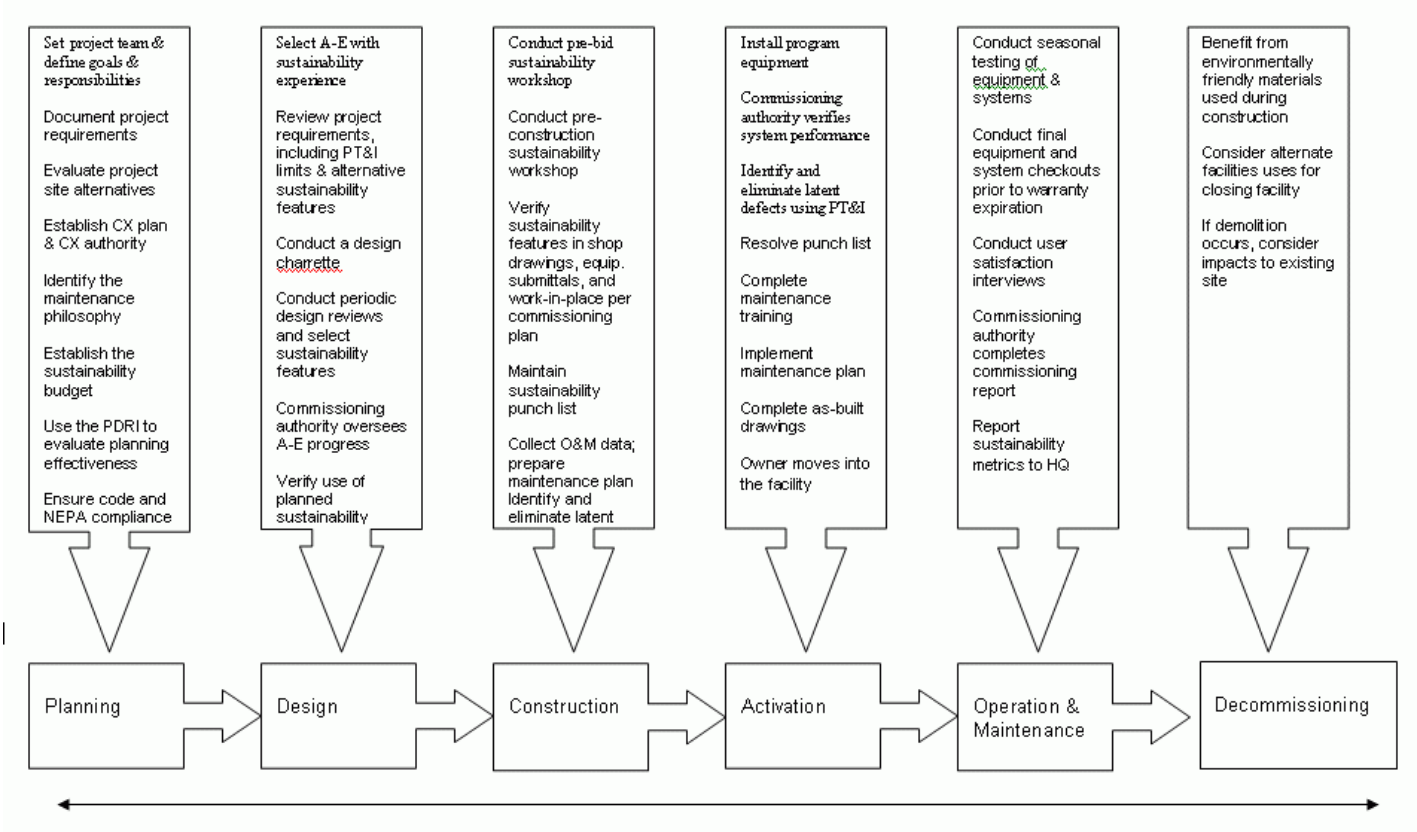


Figure G.2 - Phases of Facility Acquisition

G.3 Project Planning

G.3.1 Overview

G.3.1.1 Decisions made during the project planning phase set the project tone and direction, and have the greatest impact upon facility life-cycle costs. Establishing sustainability project goals, defining the process to achieve them, and developing a clear understanding of the expected results will enable project success. A clearly developed project framework guides the decision-making process throughout the project, incorporating issues related to site selection,

facility and system designs, the construction process, activation, facility operations and maintenance, and decommissioning.

G.3.1.2 During this phase, the project team documents the project requirements. Section 3 of the FPIG fully describes this requirements development process. Final project requirements are included in the facility Requirements Document (see FPIG Section 3.7, Requirements Document), which includes: user functionality and special needs, the local context and community issues, codes and regulations to emphasize, site and climate issues, building context and function, and building technology considerations. Examples of sustainability requirements that should be addressed in the Requirements Document include:

a. Building commissioning requirements,

b. Indoor environmental quality goals (i.e., maximum allowable carbon dioxide concentration, minimum ventilation effectiveness, desired temperature and humidity levels),

c. Lighting quality and illumination intensity,

d. Power quality and availability,

e. Maintainability requirements, including accessibility, reliability and availability, and

f. Energy use goals.

G.3.1.3 For small projects and rehabilitation or renovation work, the Requirements Document may be quite simple. For example, in a project to upgrade the fire alarm system, the Requirements Document may state, "Provide a state-of-the-art fire alarm system that meets current code, improves the protection of personnel, operates for 72 hours independent of external power, and communicates with the existing central monitoring and notification system with no more than one error per month."

G.3.1.4 Where practical, specific project requirements should be measurable. When criteria are measurable quantities, results can be compared to determine whether the requirements have been met. Rather than asking for an "energy efficient" building, the criteria might be written to require that energy consumption during the first 5 years of operation be 10-percent lower than required by ASHRAE Standard 90.1.

G.3.2 Planning Phase General Sustainability Issues.

G.3.2.1 Balance Competing priorities. Considering the many elements of sustainability early during the planning phase, and assessing impacts of various design alternatives, will maximize the degree to which sustainability elements can be implemented without increasing project design or construction costs. Sustainable design, maintainable design, building commissioning, safety and security objectives will differ among projects. Many factors will influence the degree to which elements of each component of sustainability can be implemented. For each project, many issues will dictate final requirements, including: budget constraints, schedule considerations, facility size, hours of operation, utility rates, code requirements, siting constraints, local climate, existing maintenance organization and philosophy, and existing threat environment.

G.3.2.2 Hire Experience. NASA shall select A-Es and construction contractors with proven sustainability experience. This guideline and the training workshops that reinforce its concepts will enable NASA project engineers to understand sustainability, but ultimate success will depend upon having experienced designers and contractors as an integral part of the project team.

G.3.2.3 Acknowledge the facility maintenance philosophy. Acknowledge the Center's facility maintenance philosophy, and address reliability and availability requirements. The maintenance philosophy considers an appropriate mix of reactive, preventive, predictive and proactive maintenance tasks. It considers contractor capabilities and contract requirements from the Center Operations Support Services (COSS) contract. The user and Center facility engineers must determine reliability and availability issues. More detailed discussions on NASA operations and maintenance program are included in NPR 8831.2D.

G.3.2.4 Involve Center O&M staff. COSS contractors perform operations and maintenance functions at all NASA Centers. Any decisions regarding sustainability, especially those related to maintainable design, should be made with the COSS contractor in mind. Project decisions should consider the need to perform maintenance tasks efficiently and safely. Input from the maintenance staff and COSS contractors will enhance maintainability design decisions.

G.3.2.5 Consider the Center Master Plan. Specific project requirements should consider and reflect the planning criteria with the Center Master Plan.

G.3.2.6 Address Safety and Security Concerns. NASA emphasizes the safety and security for its employees, assets and visitors. Safety and security are included within the umbrella of facility sustainability. NASA Policy Directive 8700.1 (NASA Policy for Safety and Mission Success) and NASA Procedures and Guidelines 8715.3 (NASA Safety Manual) address safety requirements for NASA facilities programs. Within the Federal government, there is a wealth of reference material for considering special safety and security requirements associated with terrorist attacks. The best reference for planning and designing Federal facilities is the Department of Defense Technical Manual 5-853, Security Engineering. This four-part technical manual includes planning and design guidance and information on electronic security systems.

G.3.2.7 Start the Building Commissioning Process. It is important to start the building commissioning process during the project planning phase. Building commissioning verifies that the facility requirements are well documented and provides the process for ensuring they are achieved. The facility Requirements Document provides the foundation for the design, construction, activation, operation, and maintenance of the facility, and is the basis for the commissioning plan and schedule. The Requirements Document should define the scope of commissioning and suggest the CA. The CA may be an independent consultant, a member of the Architect-Engineer firm, or a NASA employee, depending upon the scope and complexity of the project requirements.

G.3.2.8 Select a Commissioning Authority. For Centers embarking on their first few commissioning experiences, hiring an independent CA may be beneficial. Attachment 2 provides guidelines for selecting a CA. For smaller projects, or after experience is developed, the CA functions may be performed using in house expertise. The CA workload varies depending upon the phase a project is in, and is most intense during the final stages of construction and the activation phase.

G.3.3 Action Items. Considering the following action items during the planning phase will help the project maximize sustainability objectives within existing constraints. Attachment 1 includes a list of reference documents that provide more detailed information regarding many of these action items.

G.3.3.1 Define Responsibilities and Procedures. Within the project team identified in section 2.6.1, assign responsibilities for managing the project and the sustainability program. Use formal or informal partnering within the team to ensure early buy-in, commitment, and understanding of project sustainability goals. The NASA Partnering Desk Reference Guide (available on the NASA Headquarters Code JX Web site) defines the partnering process. At an initial project meeting, the team should discuss procedures used to exchange information throughout the project life.

G.3.3.2 Conduct a project planning charrette. A charrette is an intensive, collaborative effort involving many project team members to quickly examine project alternatives. A planning charrette will allow project team members to develop project goals, and to discuss alternatives to achieve them. The charrette will ensure appropriate options are reviewed, allow debate regarding competing project priorities, and bring the team into alignment prior to moving forward in the acquisition process.

G.3.3.3 Identify Project Sustainability Goals. Identify and describe the project's sustainability goals as part of the facility Requirements Document. The facility user requirements will dictate how aggressively each sustainability concept can be pursued. In particular, the environmental needs of each space (e.g. the desirability of daylighting, specific temperature/humidity conditions, acoustical requirements) must be considered. Sustainability goals should consider the maintenance strategy for the project, as well as safety and security considerations. Where practical, the goals should include measurable results (i.e., degree of energy consumption), which can be measured once the facility is completed. At a minimum, the goals should address the following:

a. Environmental impacts,

b. Energy conservation,

c. Use of renewable energy sources,

d. Use of environmentally preferable materials,

e. Life-Cycle Costs,

f. Indoor environmental quality,

g. Employee safety and security,

h. Operations and maintenance considerations including availability, ease of maintenance, access and safety,

i. Commissioning, and

j. Decommissioning.

G.3.3.4 Identify Certification Goals. Specify the Leadership LEED sustainability certification level desired, and identify if the project will be submitted for the Environmental Protection Agency's Energy Star rating program.

G.3.3.5 Develop A-E and Construction Contractor evaluation criterion. Establish an evaluation criterion for selecting Architect-Engineers, construction contractors and commissioning agents based upon their experience and ability with sustainability concepts.

G.3.3.6 Establish the Sustainability Budget. Set the project budget based on the design alternatives with the lowest total life-cycle cost. Identify the budget requirements to achieve the sustainability goals. Some sustainability concepts may increase the first costs of the project. The project team should conduct a life-cycle cost analysis to demonstrate the merit for incurring these additional first costs.

G.3.3.7 Use Life-Cycle Cost Analysis. Project decisions shall be driven by life-cycle cost analysis, rather than impacts only on first project costs. The life-cycle cost resource page on the Whole Building Design Guide provides an excellent tool.

G.3.3.8 Consider lessons learned. A lessons learned database supports the recording, archiving and accessing of lessons learned and best practices from other, similar projects. Evaluate if lessons learned are available. If appropriate, benchmark with other agencies to identify lessons learned. Use the NASA Lessons Learned Information System (LLIS) database to share lessons learned throughout the Agency.

G.3.3.9 Establish the Commissioning Plan. The commissioning plan captures important decisions about commissioning and ensures that everyone understands their responsibilities. The commissioning plan should incorporate or reference the owner's project requirements (OPR), identify the Center's commissioning goals, identify the CA and commissioning team members and their roles, establish the scope of commissioning in terms of systems and equipment, outline the major commissioning steps during design, construction, activation and operation, and discusses lines of communication and authority.

G.3.3.10 Evaluate Siting Alternatives. Identify and evaluate possible siting alternatives, considering solar gain (consider atrium spaces, direct or indirect passive solar heating, earth-protected spaces, and natural and constructed shading), daylighting, building orientation, and window placement. These considerations must be balanced against concerns for safety and security. Siting considerations should also consider landscape plans that contribute to the facility's energy performance (shading options, windbreaks, and use of existing site or building features) and impacts upon the natural environment.

G.3.3.11 Consider Renewable Resources. Investigate the use of renewable power sources as part of the facility's overall power supply. Consider using solar (domestic) hot water on building types with high hot water usage, such as laboratories, and Building-Integrated Photovoltaics (BIP) to reduce reliance on nonrenewable power.

G.3.3.12 Conduct a preliminary energy analysis. Consider doing a preliminary energy analysis using Energy-10 and the latest version of DOE-2 or other applicable tool for larger and more complex projects. For smaller, simpler projects (those with two or fewer zones or less than 50,000 SF), consider using other less complex energy analysis tools.

G.3.3.13 Consider resource conservation and recycling issues. Develop resource conservation strategies to limit environmental damage and maximize opportunities for reuse. Assess the direct and indirect environmental impacts of building material selections.

G.3.3.14 Consider Sustainable Technologies/Techniques/Processes. The team should evaluate using the following:

a. Passive solar technologies,

b. Daylighting,

c. Sun controls and shading,

d. Energy efficient lighting and controls,

e. Energy efficient windows,

f. Natural ventilation,

g. High performance HVAC equipment and systems,

h. Advanced environmental management control systems,

i. Underfloor air distribution,

j. Fuel cells,

k. Distributed energy,

l. Building Integrated Photovoltaics (BIP),

m. Solar water heating,

n. Biomass and biofuels,

o. Gray water and rain catchment systems,

p. Porous paving surfaces,

q. Water conserving (ultra low flow) devices,

r. Wind energy systems,

s. Xeriscaping, and

t. Microturbines.

G.3.3.16 Consider maintainable design issues. Maintainable design issues to consider during the planning phase include the following:

a. Acknowledge the Center maintenance philosophy, and balance reactive, preventive, predictive and proactive maintenance strategies accordingly,

b. Identify critical systems for the facility, and associated availability and reliability requirements,

c. Evaluate equipment choices with consideration of life-cycle costs, spare parts, maintenance staffing, standardization and interchangability, modularization, operability, maintenance task complexity, and maintenance access,

d. Establish project maintainable design metrics for inclusion in the overall OPR (i.e., target maintenance costs/SF, mean time to repair, mean time between failures, reliability measures),

e. Consider required data to support a Computerized Maintenance Management System,

f. Identifying warranty issues,

g. Identify appropriate RCBEA specifications and test procedures,

h. Consider requirements for appropriate devices to support efficient predictive testing processes, and

i. Identify staffing or training issues related to facility operations and maintenance.

G.3.3.16 Consider building commissioning issues. Building commissioning issues to consider during the planning phase include the following:

a. Quantify performance criteria for critical systems, and acceptance criteria and testing including Predictive Testing & Inspection (PT&I) limits to identify latent defects,

b. Identify systems to be commissioned,

c. Select the CA and establish their contract,

d. Create a preliminary commissioning plan, and

e. Establish A-E design phase deliverables in support of the commissioning process.

G.3.3.18 Consider Safety and Security issues. Safety and security issues to consider include the following:

a. Conduct a preliminary threat and vulnerability assessment. NASA Headquarters and Center Directors should have appropriate guidance regarding threat conditions at each Center,

b. Evaluate blast mitigation measures (stand off distances, blast walls, and blast resistant materials) that may affect planning parameters,

c. Consider access control requirements for NASA employees and visitors, including traffic patterns, barriers, delivery access, locks, and interface with security forces,

d. Consider requirements for heating, ventilation and air conditioning systems, including need for zoned systems, and access to air intakes,

e. Identify security lighting and electronic security system requirements, and

f. Complete a hazards analysis to identify and evaluate safety and risk considerations.

G.4 Design

G.4.1 Overview

G.4.1.1 During the design phase, the team creates a design with project plans and specifications that form the basis for a construction contract award. Design phase decisions regarding materials, technologies, and systems for the project will significantly affect its degree of sustainability. Once the design proceeds toward completion, opportunities to impact the life-cycle costs for the facility diminish rapidly. This section provides guidance and action items to help maximize the sustainability, meet the project requirements established during the planning phase, and produce more efficient NASA facilities.

G.4.1.2 The FPIG design reviews occur at the 30-percent, 60-percent and 90-percent stages. During these reviews the project team should assess whether sustainability enhancements and considerations have been properly applied.

G.4.2 General Sustainability Issues during the Design Phase

G.4.2.1 During the design phase, many of the project planning assumptions and decisions will be evaluated in detail. Final decisions will be made which will irreversibly affect the life-cycle performance of the project.

G.4.2.2 General sustainability issues to address in the design phase include the following:

a. Select an A-E and Commissioning Authority with Experience. Ensure the architects-engineers and consultants used on the project have experience and demonstrated capability in sustainability and commissioning practices.

b. Conduct a design charrette. The design charette process allows debate and decisions regarding competing project priorities, and helps the team select the optimal alternatives. The charette brings the team into alignment prior to moving forward in the acquisition process.

c. Conduct formal and informal design review meetings. The project team should review the specific elements of sustainability at each design review to ensure the project will achieve satisfy stated requirements. Between formal 30-percent, 60-percent and 90-percent reviews, it is appropriate to have other informal meetings to address specific sustainability elements individually.

d. Document Design Decisions. The project team should have a process for recording information about project development decisions. It is very important to document decisions made throughout the acquisition process, especially where tradeoffs must be made between competing priorities.

e. Use CII Design for Maintainability Guidebook. Refer to the CII Guidebook for specific Maintainable Design technologies and ideas.

f. Continue the Building Commissioning Process.

(1) At the beginning of the design phase the CA guides the project team in updating and completing the project commissioning plan. The commissioning plan includes actions required to achieve the project requirements. As the project requirements are translated into design documents, the designers create a basis of design document to convey the assumptions made while completing the design. Commissioning specifications detail the construction contractor's responsibilities for commissioning work, including documentation, testing, and final acceptance.

(2) Projects using the commissioning process require additional design generated documents beyond the traditional plans and specifications. The design team will need to create one-line diagrams of all systems (similar to electrical one-line diagrams), control logic diagrams (piping & instrumentation diagrams for control systems, interface wiring diagrams of communication links between systems, basis of design documentation, and design calculations. The design team shall also ensure commissioning specifications are developed for: appropriate accommodations for testing and monitoring data collection; and the ability of selected equipment and systems to operate under all loads and conditions.

g. Identify and Eliminate Latent Defects. Select and specify appropriate predictive testing and inspection requirements with specific acceptance criteria and acceptance limits, to identify and eliminate latent defects from critical installed equipment. Refer to the NASA RCB&E Guideline for more detailed guidance.

G.4.3 Action Items. The sustainability team shall perform these action items during the Design Phase to ensure the project maximizes sustainability objectives.

G.4.3.1 Maximize Site Potential - Action items to consider include the following:

a. Recognize that some sites may not be suitable for new or additional development,

b. Minimize the building footprint and associated access and parking facilities,

c. Minimize developing open space by selecting already developed land,

d. Preserve flexibility for future development adjacent to the site,

e. Integrate the building into the natural setting, preserving natural attributes and minimizing tree and vegetation destruction,

f. Orient the facility to take advantage of sun angle and wind direction, leveraging passive measures to reduce energy consumption,

g. Minimize distance from adjacent buildings, and provide pedestrian-friendly settings to minimize dependence on motor vehicles,

h. Provide bicycle racks and shower facilities to encourage alternate commuting options,

i. Provide refueling/recharging facilities for alternative fuel/electric vehicles,

j. Provide properly located sidewalks lighted for security and traffic-calming measures (i.e., narrower roads with speed controls for pedestrian safety),

k. Reduce heat islands through landscaping (i.e., use existing trees to shade walkways and parking lots) and building design methods (i.e., light-colored roofing),

l. Mitigate noise levels, both from the surroundings and from building operations by using berms or tree filters, and

m. Site facilities to accommodate the watershed drainage, and to take advantage of the visual and thermal qualities of water in land use planning.

G.4.3.2 Protect and Conserve Water - Action items to consider include the following:

a. Provide rainwater catchment areas, and segregate gray water and potable water systems. Recover nonsewage and gray water for onsite use,

b. Provide onsite gray water distribution systems and waste-treatment,

c. Develop strategies for mitigating runoff (all construction activities disturbing 1 or more acres must apply for National Pollution Discharge Elimination System (NPDES) permit coverage for storm water as required by the Storm Water Phase II Final Rule (64 FR 68722),

d. Provide water and condensate recovery systems and water-conserving cooling towers,

e. Use indigenous plants and beneficial landscaping to minimize irrigation needs,

f. Use pervious surfaces for low-traffic volume roadways and parking areas and biofiltration swales and retention ponds to minimize infiltration and runoff, and

g. Use water efficiently through ultra-low-flow fixtures, water-conserving cooling towers, and other actions (i.e., sensor faucets).

G.4.3.3 Minimize Energy Consumption - The design team should evaluate the appropriateness of each of these energy saving alternatives using life-cycle cost analysis. Alternatives to consider include the following:

a. Building energy performance must meet or exceed 10 CFR 434 requirements.

b. Buildings must have meters for all energy sources and potable water supplies.

c. Use the natural attributes of a site for optimal lighting, ventilation, heating, and cooling. Consider options like solar shading for summer, stone masonry during winter to take advantage of seasonal changes in solar radiant heat gain. Use colors that reflect or absorb solar radiation. Place and sizing openings appropriate to the solar angles.

d. Integrate technologies, including solar energy, wind energy, fuel cells, biomass energy, and microturbines, to further reduce nonrenewable energy consumption.

e. Use trees and other vegetation to redirect prevailing winds, and to shade the structure.

f. Reduce the facility's surface-to-volume ratio while maintaining useable spaces to accommodate user activities.

g. Increase absorption wall mass to enhance thermal storage (e.g. Trombe walls, where desirable).

h. Apply controllable natural ventilation, or airtight insulation to match the climactic conditions.

i. Specify efficient e- and R-values for windows, doors and wall insulation, and window operability.

j. Incorporate structural measures including overhangs, light wells, photovoltaic cladding, ceiling height, and facility dimensions that will leverage increased energy efficiency of the integrated mechanical and electrical systems.

k. Optimize the sizing of heating, ventilation and air-conditioning equipment against reduced heating and cooling loads of lighting and the building envelope.

l. Optimize cross-ventilation or use ceiling fans where natural ventilation is feasible.

m. Select energy-efficient heating, ventilation, air conditioning, and humidity conditioning equipment, and high-efficiency variable speed motors and fans. Control and monitor these systems using an Energy Management Control System.

n. Consider humidity conditions appropriate for the intended use.

o. Design the HVAC system to exceed ASHRAE Standard 90.1-1999 for thermal comfort requirements.

p. Comply with indoor air quality standards (ASHRAE 62-1999) while minimizing energy required to condition fresh intake air and using heat exchangers between intake and exhaust ducts.

q. Use high efficiency, solar assisted hot water heaters for large hot water loads, and on-demand water heaters for low loads.

r. Minimize pipe lengths where central hot water storage and chilled water is required.

s. Consider cogeneration to produce heat and hot water from a single-power source (e.g., reuse the hot water or steam generated by fuel cells).

t. Specify Energy Star™ office equipment and appliances (e.g. computers, copiers, printers, fax machines, refrigerators, microwaves, washers and dryers) and select energy efficient installed equipment, such as elevators and water heaters.

u. Use shared natural daylighting, (e.g., skylights, clerestories, light shelves) to reduce the need for artificial lighting.

v. Use area-specific lighting levels that will allow reduced ambient lighting levels and energy-efficient, low-heat-producing, electronically ballasted lamps and fixture with automatic controls.

w. Consider thermal storage.

x. Consider relationship of the facility to campus-wide utility systems.

G.4.3.4 Use Environmentally Preferable Products - Action items to consider include the following:

a. Check with Center Environmental Program Managers for listing of environmentally preferable products, programs, or specifications that may already be developed.

b. Avoid using endangered, nonrenewable products.

c. Design building dimensions to allow for use of resource-efficient systems (e.g., matching building dimensions to standard-size furniture and interior fittings to eliminate waste created through custom fitting).

d. Use demountable and reusable interior building components to accommodate changing facility requirement.

e. Specify durable, low-maintenance materials or encouraging the use of recyclable assemblies and products that can be deconstructed at the end of their useful lives.

f. Specify locally available materials with manufacturing processes that optimize benefits to local economies.

g. Specify materials harvested on a sustained-yield basis, such as lumber from certified forests.

h. Eliminate the use of materials that pollute or are toxic during their manufacture, use, or reuse.

i. Identify materials covered by the Recovered Materials Advisory Notices issued by the Environmental Protection Agency under its comprehensive procurement guidelines.

j. Apply the BEES software developed by the National Institute for Standards and Technology to select materials with the desired combination of environmental benefits.

G.4.3.5 Enhance IEQ - Action items to consider include the following:

a. Use materials that minimize noise pollution and toxic emissions,

b. Maximize use of daylighting,

c. Provide for sufficient replenishment of fresh air,

d. Provide a well-designed interior environment that is visually and acoustically pleasing,

e. Ensure acoustic privacy and comfort through the use of sound-absorbing material and equipment isolation,

f. Consider noise levels appropriate for the intended use,

g. Provide thermal comfort with maximum personal control over temperature and humidity,

h. Control disturbing odors through contaminant isolation and proper ventilation,

i. Provide separate chemical storage areas with separate ventilation,

j. Install a permanent air-monitoring system to ensure compliance with indoor air quality objectives,

k. Locate air intake ducts away from fume-producing areas, such as loading docks and driveways,

l. Use separate ventilation for interior work areas that produce noxious fumes,

m. Reduce or eliminate materials (paint, carpet, particleboard, adhesives) that contain toxic or hazardous substances, such as lead, asbestos, and volatile organic compounds, that affect human health,

n. Replace ozone-depleting substances such as chlorinated fluorocarbons in refrigeration equipment and specify PCB-free transformers and other electrical equipment, and

o. Provide radon infiltration barriers if required.

G.4.3.6 Consider the Existing Center Maintenance Strategy - The Center strategy suggests the degree of application of modern maintenance practices, use of COSS contractors to operate and maintain systems, and availability of equipment and resources for performing maintenance practices. The project team should consider the maintenance strategy when evaluating these action items for the project. Action items to consider include the following:

a. Review the maintenance philosophy and objectives identified during the planning phase with the sustainability team; the philosophy should comply with existing NASA policies and guidelines (i.e., NPR 8831.2D, Facilities Maintenance Management).

b. Prioritize the systems and equipment according to their criticality to the facility operations.

c. Identify those systems or equipment that might require specialized maintenance practices, including special design consideration or application of predictive maintenance practices.

d. Identify equipment and devices required for predictive testing and condition monitoring, and ensure they are included in the computerized maintenance management system.

e. Include Center O&M staff, including (COSS) contract staff, in the design review process. The COSS contract requirements and capabilities should be considered in design decisions.

f. Consider the Computerized Maintenance Management System (CMMS), and requirements to provide appropriate equipment inventory, scheduled maintenance tasks, warranty, parts information, and condition monitoring results into the CMMS.

g. Establish maintainable design metrics to measure the degree of success. Metrics might include: maintenance costs per facility square foot; mean time to repair; reliability or availability percentages; mean time between failure. These metrics will enable the team to measure project success upon completion.

h. Provide O&M staff with results of any failure analyses performed on critical equipment during the design process.

G.4.3.7 Review Maintenance Safety, Accessibility and Ergonomics - Action items to consider include the following:

a. Consider ergonomics for O&M personnel, including: height and location of equipment; easy and clearly identified access points for maintained components; minimal equipment in high locations; proper illumination in maintenance spaces and display panels; convenient hoisting mechanisms where required; noise levels of equipment that won't impede staff performance or maintenance activities,

b. Consider temperature, humidity, and other environmental considerations relative to the location and operating environment of critical equipment,

c. Provide appropriate access to operate and maintain equipment and systems. Some of the more important access considerations include: size and location of doorways, elevator or lift requirements for higher floors, hinging or release mechanisms on access plates or doors, tool requirements for access doors, labeling of access panels or doors, and

d. Provide removable insulation for piping at maintenance access points, and provide reasonable access points for pipe chases and ducts.

G.4.3.8 Minimize Maintenance Task Complexity - Action items to consider include the following:

a. Consider operations and maintenance task complexity when selecting equipment,

b. Provide clearly written and readily accessible maintenance guidelines,

c. Consider requirements for spare parts and tools when selecting equipment, and

d. Consider the environmental conditions when locating equipment requiring significant maintenance activity (situations where O&M personnel will be subjected to temperatures above 90 degrees or below 40 degrees).

G.4.3.9 Use Standardization, Interchangeability and Modularization of parts and systems - Action items to consider include the following:

a. If Center standards exist, specify common equipment to avoid the need for multiple suppliers, spare parts, and training requirements;

b. Specify standard equipment racks and consoles for similar equipment;

c. Specify common modules for similar equipment;

d. Use common nomenclatures, preferably using a Centerwide standard;

e. Where cost effective, specify plug in modules or components that can be replaced without tools, and repaired in controlled environments;

f. Where possible, design systems to allow single component or module replacement without impact to other components or modules to avoid damage to associated equipment;

g. Specify common fasteners throughout specific systems; and

h. Minimize the number of piping systems, sizes of pipes, and variance in pipe materials.

G.4.3.10 Consider Safety and Security - Action items to consider include the following:

a. Review safety and security issues identified during the planning phase regarding hazards analysis, threat and risk assessment, blast mitigation requirements, access control, lighting, and security systems. This information forms the basis for beginning design development for safety and security.

b. Evaluate seismic zone requirements. If not in seismic zones 3 or 4, evaluate if additional structural hardening is appropriate to mitigate collapse.

c. Identify security lighting and electronic security system requirements.

d. Consider access control requirements, including traffic patterns, barriers, delivery access points, locks, and interface with security forces.

e. Refer to Department of Defense Security Engineering Technical Manuals 5-853-1 thru 5-853-4, and GSA's Public Building Services P-100, which provide more detailed guidance for evaluating appropriate security requirements in Federal facilities. The Architect-Engineer team should review these requirements and propose appropriate security measures given the threat assessment, facility location, and facility criticality.

f. Consider accessibility requirements for people with disabilities.

G.4.3.11 Support Building Commissioning - Action items to consider include the following:

a. Provide control logic diagrams - Control logic diagrams, or detailed pseudo-code consisting of if-then statements, define the required control of systems with less ambiguity than text-based sequences of control. These should be complete at the end of schematic design.

b. Provide one-line system diagrams - One-line diagrams of all mechanical services, similar to plumbing riser diagrams, are necessary to clarify and troubleshoot system operation. These also should be complete at the end of schematic design.

c. Provide interface wiring diagrams - Interface wiring diagrams eliminate the ambiguity of system connections. The diagrams show communication or signal wiring interfaces between systems, indicating the panels, wiring configuration, and the nature of the signals. These also should be drafted at the end of design development and completed in the construction documents.

d. Document the Basis of Design. The design team documents the basis of design, which includes among other things: outdoor summer and winter design conditions, indoor summer and winter environmental comfort requirements, lighting parameters, power quality and reliability, utility capacities at the site, assumptions about types of use and occupancy schedules. The CA reviews the Basis of Design for compliance with the facilities Requirements Document.

e. Conduct a Commissioning Design Review. Review the project design at the 30-percent, 60-percent and 90-percent stages. The project team, led by the CA, ensures the design properly considers the OPR, and evaluates: system operation under all operating conditions and loads; that adequate access is provided for safe, cost-effective maintenance and operation; and that system interfaces are designed to function as intended. During early design stages, the reviews focus on appropriate system selection, and adequacy of space for mechanical and electrical equipment.

f. Adjust the Commissioning Plan. The CA adjusts the commissioning plan throughout the design phase based upon decisions and changes as the project matures. Changes are common on most projects, and may be the result of changing user requirements, technology improvements, budget concerns, schedule concerns, or other factors. The commissioning plan includes sections regarding the following important areas:

(1) Lines of communication and authority for commissioning team members,

(2) Listing of shop drawings and product submittals requiring CA review, and

(3) Functional testing requirements throughout the construction and activation phases.

g. Prepare Commissioning Specification - The commissioning specification should be developed during the design phase. In some instances, a set of draft functional performance test (FPT) and RCB&E predictive testing procedures and data forms is included in the bid documents in place of the FPT descriptions. This gives construction contractors an advance understanding of their commissioning testing requirements. The downside of this approach is the volume of paper added to the bid package, and the need to adjust the procedures to after approved shop drawings and product submittals are received. The commissioning specification identifies the commissioning work required by the construction contractor, and will include the following:

(1) Qualification requirements for someone to lead the contractor's commissioning efforts;

(2) Requirements for submittal and shop drawing reviews;

(3) Requirements to submit and manage the commissioning schedule, integrated with the construction schedule;

(4) Reporting and documentation requirements;

(5) Requirements for completing FPT, and RCB&E predictive testing to identify latent defects, during the construction and activation phases. Test specifications should describe for each test: the systems and equipment to be tested; the functions to be tested; the conditions for the testing; and the measurable acceptance criteria; and

(6) Closeout requirements tied to the general conditions of the construction contract.

G.5 Construction

G.5.1 Overview

G.5.1.1 The construction phase presents many opportunities to stray from a well-developed sustainable design. During construction, the building commissioning aspect of sustainability moves to the forefront, as plans and specifications give rise to a fully functioning and sustainable facility.

G.5.1.2 During construction, the sustainability team will exercise the construction phase elements of the commissioning plan, performing important shop drawings and material submittal reviews, functional performance and RCB&E tests, and quality assurance checks. This section provides a checklist of action items to follow during the construction process. The ultimate objective is to produce a facility that meets documented facility requirements.

G.5.2 General sustainability issues to consider during the Construction Phase

G.5.2.1 The roles and emphasis of sustainability team members change as the project moves into the construction phase. Operations and maintenance personnel increase their involvement to ensure equipment meets minimum maintainability requirements. Building commissioning takes on an increasingly more important role during the construction phase. The interface between the construction contractor, commissioning authority, and other team members becomes very important to the success of the project.

G.5.2.2 The volume and pace of activity during the construction process increases. Good communication regarding submittals, approvals, schedules and project progress is essential to allow the project to remain on schedule, within budget, and moving to achieve the project requirements.

G.5.3 Action Items. The project team should consider the action items in the following paragraphs during the construction phase to ensure the project maximizes sustainability objectives established in the facility requirements document and developed in the final project design.

G.5.3.1 Construction Contractor Selection - Many construction contracts are awarded to the lowest responsive, responsible bidder in a firm fixed priced, sealed bid approach. The team should consider an award based upon best value, considering price and other technical factors. One technical criterion for the best value evaluation process is the contractors experience and understanding of sustainability.

G.5.3.2 Conduct a preconstruction partnering session - The partnering session provides an opportunity to bring the newly selected construction contractor onto the project team, and to establish working relationships and project expectations. All team members will begin to understand the project objectives. Process issues should be discussed, including submittal and shop drawing reviews and approvals, conduct and timing of functional performance and RCB&E testing, access to the project site by O&M personnel, and other required building commissioning efforts.

G.5.3.3 Require an indoor environmental quality plan - To reduce negative impact on the building and building occupants, especially during renovation projects, require an Indoor Environmental Quality Plan. With regard to construction, the IEQ plan should include requirements for protecting the building materials, sequencing material installation, ventilation requirements, and keeping the site clean and hazard free. The Sheet Metal and Air Conditioning Contractors Association has an Indoor Air Quality (IAQ) guideline for buildings under construction, IAQ Guidelines for Occupied Buildings Under Construction.

G.5.3.4 Require site conservation practices - The construction contract should require the contractor to preserve the integrity of the site and existing habitat. Enforcement of these requirements (erosion control, tree cutting) is important to sustaining the existing site.

G.5.3.5 Minimize Construction Wastes - The construction contract should emphasize minimizing wastes generated during the construction process. The design and subsequent construction should emphasize source reduction, materials reuse, and waste recycling. Source reduction is most relevant to new construction and large renovation projects and involves reduced "waste factors" on materials ordering, tighter contract language assigning waste management responsibilities among trade contractors, and value-engineering of building design and components. During renovation and demolition, building components that still have functional value can be reemployed on the current project, stored

for use on a future project, or sold on the salvage market. Recycling of materials can be accomplished whenever sufficient quantities can be collected and markets are readily available. Management and minimization of hazardous materials disposal is also very important.

G.5.3.6 Establish a Submittal Review and Approval Process - Requiring the contractor to provide materials that comply with project specifications, and support sustainability requirements are critical. The project team should have a clearly established review and approval process that involves the proper team players without unduly delaying the construction contractor. Materials should be evaluated to ensure they are meeting environmentally preferable product requirements, energy consumption requirements, maintainability requirements (standardization, complexity, maintainability), and functional requirements. Where appropriate, the Center may have a preferred supplier list or request proprietary items to support overall maintainability or environmental objectives.

G.5.3.7 Schedule Periodic Site Walk Throughs - Coordinate periodic site walk throughs to familiarize O&M personnel with the facility during construction, and before components become hidden by wall, ceiling or floor covering. Special attention should be paid to accessibility and maintainability issues during the walk throughs.

G.5.3.8 Building Commissioning during Construction - Commissioning activities during construction include scheduling and coordinating designated submittal reviews, functional performance and RCB&E testing, finalizing FPT and RCB&E procedures and data forms for later use, observing construction for commissioning-related issues (such as location and sizing of control components), performing static tests, and beginning operator training. This sets the stage for energizing and functionally testing systems during project activation. Specific actions on a typical project might include the following:

a. Prebid Meeting - If appropriate, conduct a prebid meeting to ensure that bidders are aware of their commissioning responsibilities.

b. Update Commissioning Plan - Update commissioning plan to include information about the contractors and suppliers selected, including details of lines of communication for commissioning correspondence and notifications. Having the construction contractor copy the CA on certain types of correspondence can improve coordination without compromising the chain of command.

c. Update Commissioning Schedule - The contractor integrates commissioning activities into the master construction schedule. Commissioning activities and milestones should be tied to appropriate predecessor construction activities, should have estimated durations and completion dates, and be tied to dependent activities. As construction progresses, the contractor updates and refines the commissioning schedule items at each submittal of the construction schedule.

d. Commissioning Coordination Meetings - Conduct periodic commissioning coordination meetings to review the commissioning schedule, submittal status, upcoming functional performance testing, and results of recent tests. Attendees should include the construction contractor, CA, appropriate design team staff, project manager, Quality Assurance (QA) staff, and on occasion O&M, energy or environmental representatives. For convenience, these meetings often follow the construction progress meetings.

e. Commissioning Submittal Review - Primary responsibility for review of contractor shop drawings and product submittals remains with the designers of record. However, the CA should review submittals critical to the commissioning process concurrently. These include all control system equipment, shop drawings, and control logic or program code submittals, and submittals of central equipment such as boilers, chillers, generators, fans, pumps, meters, and switchgear. The commissioning review focuses on the ability of the submitted equipment and control logic to meet the project requirements.

f. Functional Performance and RCB&E Testing (FPT) Procedures and Data Forms - The CA or the contractor G.5.3.8. generate original FPT and RCB&E test procedures and data forms, or update the draft FPT procedures and forms (from the bid documents), to correspond with the approved equipment and control logic submitted by the contractor. If the CA updates the draft procedures, the contractor should review them to identify: any safety concerns; procedures that cannot be executed with the approved equipment or control logic; and for options to perform the FPTs more efficiently. The procedures and data forms contain the detailed instructions on how to execute the tests and what information to record. Procedures contain sufficient detail that any competent technician can perform the test without further instruction, with repeatable results. Data forms provide space to record observed performance. Attachment 3 provides an example FPT specification.

g. CA Observe Construction - The CA observes important aspects of construction adds focus on issues of accessibility, maintainability, and "commissionability." Commissionability means that equipment and systems can be tested to verify they perform as intended. For example; flow sensors and meters located too close to a fitting cannot provide accurate flow information; or lack of test ports may preclude measuring system performance; or there may not be safe access to

air terminal units in a crowded ceiling.

h. Static Tests - The contractor performs and the CA observes static tests. Examples of static tests include pipe and duct leak tests, and cable insulation integrity tests. Because of their importance to subsequent commissioning activities, static tests should be administered under the same stringent procedures as FPT's. They should follow written procedures, have measurable acceptance criteria, and the written test data should become part of the commissioning record. Static tests are prerequisites to component and system FPT's.

i. Predictive Testing to Identify Latent Defects - The contractor performs and the CA observes RCB&E tests using predictive technologies aimed at identifying latent defects in installed equipment.

j. Operations and Maintenance Program - Throughout the construction phase the sustainability team should be tailoring the O&M program to support the installations maintenance philosophy. O&M manuals providing information on the operation and maintenance on the installed equipment are required. These manuals are typically supplied by the construction contractor and their equipment suppliers; however, the FPM may satisfy this requirement using other means. The O&M program within the project should support the Center's O&M program philosophy. Contractors must provide information electronically, and with enough detail to support interface with the Center's CMMS system. Manufacturer warranty information and manuals should be compiled for easy access and interface with the CMMS system.

k. Operations and Maintenance Training - O&M training must start during construction to ensure the O&M staff is ready to operate the facility upon final completion. Designers, contractors, and the CA participate in training to convey the knowledge each of them has gathered during the project. Review training materials and the qualifications of trainers to ensure effective delivery. Videotape formal training sessions for future use.

G.5.3.9 Safety and Security During Construction - The project team should ensure appropriate safety guidelines are followed during the construction process. The process of building commissioning should ensure required safety and security systems are installed and operate as designed.

G.6 Activation

G.6.1 Activation Overview.

G.6.1.1 During activation the contractor is still on site resolving punch list items and completing required commissioning testing. Facility occupants are moving furniture, equipment, and in some cases personnel into the newly completed or renovated facility. The O&M staff is ramping up to assume responsibility for daily operation and maintenance of the facility. Having a well established, clearly documented commissioning plan helps everybody better understand roles, responsibilities, and important functions to perform during this busy period.

G.6.1.2 Building commissioning activities during the project activation phase ensure systems and components are working in accordance with the facility Requirements Document. All system parameters are assessed, including energy, water, environmental, maintainability, and functionality requirements. During the activation phase, O&M and custodial staffs receive final orientation and training to ensure preparedness to operate and maintain the facility. Facility users should be briefed about how their daily activities will affect performance targets and about the sustainability features of the facility.

G.6.2 General Issues to Consider During Activation.

G.6.2.1 Building commissioning activities are most critical during the activation phase. During this phase final component level testing is completed, and integrated equipment and system level FPTs are performed by the contractor, and verified by the CA. As necessary, adjustments and retesting must be performed, normally under very tight time constraints, and coincident with users trying to move into the facility.

G.6.2.2 The O&M staff begins operating equipment under actual conditions. The activation phase provides an excellent opportunity to put equipment through a "dry run," before the facility becomes fully occupied. This allows initial lessons to be learned.

G.6.3 Action Items. The sustainability team should consider the actions in the following paragraphs during the Activation Phase to ensure the project maximizes the sustainability objectives.

G.6.3.1 Conduct Final Training and Orientation - Verify that occupants, O&M staff, and custodial contractors understand building systems and proper procedures and use of sustainable design features such as operable windows and lighting controls.

G.6.3.2 Establish O&M Baselines - Establish a baseline of operating parameters for the operations and maintenance program. Consult metrics and lessons learned from previous projects, as well as, industry norms and manufacturer specifications. Use this baseline to assess facility degradation during the life of the facility, and to trigger appropriate maintenance or repair activities in the future.

G.6.3.3 Building Commissioning in Project Activation - A number of important actions including those listed in the following paragraphs remain to complete the commissioning process.

a. Energize and test equipment - Many component-level FPT's can and should be performed before equipment startup to minimize the disruptions to the startup process. Many of these early FPTs occur during the construction phase. After initial FPTs are satisfied and equipment installation is complete, the remaining component-level FPT's can be completed.

b. Perform Component-level FPT's - Component-level FPT's exercise the simplest assemblies in our systems, such as switches, relays, sensors and actuators. The FPT's are relatively simple and deficiencies tend to be easy to troubleshoot and correct. Examples of component-level FPT's include calibration of outside air temperature sensors, over-current response time of an electrical protective device, the ability of a damper motor to smoothly modulate the damper between full open and full closed. For critical components, such as protective devices, the tests are quite sophisticated, requiring expensive equipment and operator expertise. Component-level FPT's lend themselves to standardization. Judgment must be exercised to select the level of rigor applied to testing a particular component. For example, an outside air temperature sensor needs to be accurate over a wide range of temperatures, so calibrating it at two temperatures may be warranted. However, a room temperature sensor may only see a few degrees of variation, so a single temperature calibration at the control set-point temperature may be adequate.

c. Perform Balancing & Verification - Testing, adjusting and balancing (TAB) is a critical component of the commissioning process. If the contractor performs balancing, then the commissioning process verifies the results. It is recommended that the balancing agency demonstrate the accuracy of a sample of their final readings when they finish their work. If the readings do not correspond to their report, then the report is rejected.

d. Consider ambient and load conditions - Some system and intersystem FPT's are dependent upon ambient or occupancy conditions. These FPT's will be performed later and should be excluded from functional completion schedule requirements.

e. Witness FPTs - The contractor performs preliminary functional tests to make sure all equipment and systems work as required. The contractor then demonstrates to the CA, or some other owner witness, some or all of the FPT's to prove their success. The results of the FPT demonstrations determine whether the commissioning work will be accepted. It is important, therefore, to make sure a knowledgeable witness is present to observe the demonstrations, and to countersign the test data records to authenticate them.

f. Look-Ahead Schedules - The contractor should create look-ahead commissioning schedules before activation FPT testing begins, and update them frequently during the activation phase. Look-ahead schedules contain the following information for each FPT required during the scheduled period: FPT number and title, equipment or systems to be tested, starting date, time and duration, starting location, contractors and suppliers who must attend or be available on site during the tests, and a list of test equipment or instruments with identification of who is responsible for providing them. Two-week commissioning look-ahead schedules may not be necessary for very small projects; simple test schedule notification forms may be adequate for the few tests involved.

g. Perform System FPT's - System FPT procedures are more complex and tend to be created for each individual project, perhaps starting from a similar procedure used previously. System FPT's exercise discrete systems, such as the emergency power system, the heating water system, or an air handling system, through a full range of operating conditions and loads. For example, for an air handling system there may be an FPT for outside air volume control that would measure the volume of outside air as the economizer modulated and as the total system flow varied. Every normal and emergency mode of operation is tested under the full range of loads.

h. Perform Intersystem FPT's - When all systems involved in a particular interface have been successfully tested, the intersystem operation of those systems can be verified. Intersystem FPT's are the most complex, and usually the most interesting tests. A typical test involves disconnecting the building from the electric utility grid and verifying the performance of various systems that are required to respond in an emergency power mode of operation. The fire alarm system should function without interruption of abnormalities. Some portions of the HVAC system may remain active, and may have a specific mode of operation for emergency power. Lighting controls may be required to reconfigure lighting. The security system would be expected to operate normally, without compromising safe egress or unauthorized entry. During the emergency power condition, create a fire alarm condition. Again, verify that all systems

respond in the prescribed manner. Finally, restore normal power and check that all systems return to normal operation without human intervention. Other intersystem tests may involve space temperature control under natural or false loads, and indoor air quality under simulated or real occupant loads.

i. Track Deficiency Resolution - In the course of commissioning, conditions will be discovered that are at variance with contract requirements or the Requirements Document. These variances are referred to as deficiencies. When deficiencies have been corrected, written correction reports initiate retests to verify that the corrections were complete and effective. The construction contractor must track these deficiencies from discovery to correction and successful retesting.

j. Set Up Performance Monitoring - Misaligned equipment drifts out of adjustment quickly, creating conditions for premature failure. The benefits of commissioning are enhanced by monitoring the performance of equipment and systems throughout the life of the facility. Part of the commissioning process is to establish performance-monitoring tools. The contractor establishes data trend logs and alarms to alert the operations and maintenance staffs when performance deteriorates, indicating the need for service, or in extreme cases, replacement under the manufacturers warranty. Verification of the proper operation of the alarm points and trend logs is included in commissioning.

k. Incorporate New Equipment into Maintenance Program - New equipment and systems must be included in the owner's maintenance management program. Either the contractor or the CA may be hired to assist the facility staff or maintenance contractor in entering information about the new equipment and systems into the maintenance management program. Otherwise, the facility staff or maintenance contractor needs to complete this task prior to or immediately after substantial completion. Information required for each piece of equipment includes: inventory number, equipment name, location (building, floor, room, zone), manufacturer, model and serial number, date acquired, and size (capacity, voltage, current, weight, horse power, or dimensions).

G.6.3.4 Safety and Security During Activation - During the activation process safety and security systems will undergo their final system FPTs. Safety and security advocates should ensure their systems operate according to the facility project requirements. Appropriate operational and maintenance training for these systems should be performed during the activation phase.

G.7 Operations and Maintenance (O&M)

G.7.1 O&M Overview. This Section identifies issues and actions required to ensure a facility continues to meet the requirements established in the facility Requirements Document, while consuming a minimal amount of O&M resources.

G.7.2 General issues to consider during facility O&M

G.7.2.1 Centers must produce projects that support their O&M philosophy. That philosophy must be consistent with NASA NPG 8831.2D, Facilities Maintenance Management and the NASA Reliability Centered Maintenance Guideline. These policies encourage the use of modern maintenance practices, combining a prudent mix of reactive, preventive, predictive and proactive maintenance.

G.7.2.2 Centers must budget adequate resources to continue the proactive maintenance program established during the planning, design, construction and activation of the facility. Careful planning went into the creation of an optimal O&M program. Deviations from the program due to budget adjustments must only be made with a full understanding of the life-cycle cost ramifications.

G.7.2.3 Centers must evaluate O&M contract requirements to ensure contractors can support recommended O&M programs. In many cases, O&M contractor involvement during earlier phases of project development is crucial and Centers must budget to allow for contractor participation. Input from the contractor community regarding latest trends and industry practices for O&M are encouraged. Appropriate funding is needed to provide required training for O&M staff.

G.7.2.4 Perform periodic re-commissioning, to verify that facility performance continues to meet the OPR. This regular comparison will identify drop offs in facility performance, and allow appropriate adjustments to maintain performance at or near optimal levels. As part of this ongoing evaluation process, the O&M staff should establish lines of communication with building occupants, so any notable anomalies are promptly identified. Tool 7B in the Construction Industry Institute (CII) Maintainability Implementation Guide (1999) provides a sample user feedback mechanism.

G.7.3 Action Items. The project team should consider the following action items during the O&M phase to ensure the project maximizes the sustainability objectives:

a. Optimize O&M operations by considering the following:

(1) Following established O&M procedures, and adjusting procedures appropriately based upon actual experience. Collect data regarding equipment failures and causes, and performing appropriate failure analyses to determine required adjustments to existing O&M programs. Use condition feedback data, and lessons learned as well.

(2) Measuring effectiveness of O&M operations. Tool 16 in the CII Maintainability Implementation Guide (1999) and the NASA NPG 8831.2D provide listings of metrics to consider.

(3) Providing appropriate incentives to continually encourage improvements in O&M programs.

(4) Maintaining a lessons learned file for maintainability suggestions and best practices.

(5) Conducting periodic maintainability assessments, focusing on opportunities to improve the O&M program.

b. Protect and conserve water by using environmentally friendly landscaping practices, planting native species to minimize irrigation, fertilization and pest control requirements, and using gray water systems for irrigation,

c. Use environmentally preferable products for O&M and user requirements, including recycled content materials and use of high efficiency equipment,

d. Use environmentally preferable cleaning products,

e. Establish reuse and recycling programs to eliminate offsite waste disposal,

f. Enhance IEQ by using properly sealed vacuum cleaners, regularly cleaning heating , ventilation, and air-conditioning (HVAC)ducts and filters, and if installed, using air quality monitors to assess IEQ,

g. Minimize energy consumption by utilizing the following:

(1) Measuring overall consumption against target levels,

(2) Refer to original design criteria, and if necessary consult with the original design team when making adjustments to HVAC systems,

(3) Maintain training for O&M personnel to ensure systems are properly operated and maintained,

(4) Providing facility users basic training on the function of critical systems, and a mechanism for providing feedback regarding operational problems, and

(5) Effectively using automated monitors.

h. After activation, any follow on commissioning activities are the owners responsibility. Some possible commissioning activities include the following:

(1) Ensure the CA follows up on any deferred FPTs that could not be completed during the activation phase. Deferred FPTs may be called for if seasonal conditions prevent full loading of critical systems.

(2) Perform FPTs, and apply appropriate PT&I tests prior to expiration of warranty. These tests will ensure there are no latent defects evident prior to the warranty expiration date. The commissioning plan should have identified end-of-warranty testing requirements.

(3) Perform periodic condition monitoring tasks using predictive technologies.

(4) Retain and refer to commissioning documentation as a baseline to compare ongoing O&M performance.

i. Safety and Security Issues - After occupancy, safety and security advocates should remain aware of system performance compared to original project requirements. As facility or operational requirements change, appropriate changes to safety or security systems may be warranted.

G.8 Decommissioning

G.8.1 Decommissioning Overview. This Section describes a decommissioning phase in the acquisition process to bring attention to the opportunities to continue sustainability concepts through the full facility life cycle. Properly planned, designed and constructed facilities should consider the final disposition of the facility to minimize impacts to the environment. In addition, well-planned facilities can save resources as facilities transition from one use to another.

G.8.2 General issues and action items to consider during facility Decommissioning

G.8.2.1 Evaluate whether demolition, conversion, transfer, or lease is an appropriate decommissioning method. When a building or space reaches the end of its useful life, converting the structure for an alternate use is normally preferable to demolition. In cases where the facility is excess to NASA requirements, options including transfer to other agencies or lease/reuse to other entities should be considered.

G.8.2.2 Consider deconstruction rather than demolition. Deconstruction provides many opportunities for waste reduction, reuse, and recycling of building materials and components. Deconstruction also reduces material costs for the converted facility. Actions items related to deconstruction include the following:

a. Consider deconstruction when adaptive reuse is not an option;

b. If the facility was designed with deconstruction in mind (not likely for older facilities), evaluate what components can be easily salvaged for reuse or made available for recycling (i.e., high value items like antique brick, hardwood flooring, large structural timbers, modern mechanical equipment, and specialty masonry, woodwork or metalwork). Maintain a network of salvage and recycling firms in your area;

c. Maintain an on Center location for storing reusable items;

d. Coordinate reuse of salvaged items by specifying their use in projects under design and development;

e. Avoid salvage and reuse of low-efficiency equipment; and

f. If demolition is used, ensure the demolition contractor follows reasonable processes to minimize land filled materials. Actions to promote this include the following:

(1) Allow the demolition contractor rights to all materials that are not salvaged. It is probable that such contractors will have better insight into what materials can be reused or recycled, and their proposed price may reflect the proceeds from these activities,

(2) Ensure hazardous materials are properly identified, and require disposal in accordance with applicable laws and regulations, and

(3) Coordination with the Headquarters Environmental Management Division.

ATTACHMENT G1. References

This attachment includes significant references and resources for implementing sustainability concepts on NASA projects. Additional references are available through the Whole Building Design Guide.

AG1.1 Federal Mandates:

Executive Order 13123, "Greening the Government Through Efficient Energy Management" National Construction Goals.

AG1.2 Publications:

AG1.2.1 Green Buildings - Guidelines for Creating High-Performance Green Buildings by the Pennsylvania Department of Environmental Protection. 1999.

AG1.2.2 Greening Federal Facilities Guide by U.S. Department of Energy. 2001.

AG1.2.3 High Performance Building Guidelines) by New York City Department of Design and Construction. April 1999.

AG1.2.4 Maintainability Implementation Guide (1999). Construction Industry Institute (CII), University of Texas at Austin, Austin, TX.

AG1.2.5 Sustainable Federal Facilities - A Guide to Integrating Value Engineering, Life-Cycle costing, and Sustainable Development by Federal Facilities Council. Washington, DC: National Academy Press, 2001.

AG1.3 Organizations:

AG1.3.1 Sustainability

AG1.3.1.1 Sustainable Buildings Industry Council (SBIC)

AG1.3.1.2 U.S. Green Building Council (USGBC)

AG1.3.2 Enhance Indoor Environmental Quality. The following are relevant codes and standards:

a. ASHRAE Standard 55-1992 - Thermal Environmental Conditions for Human Occupancy, 1992,

b. ASHRAE Standard 62-1999 - Ventilation for Acceptable Indoor Air Quality, 1999. Sets the minimum acceptable ventilation requirements.

c. American Society of Heating, Refrigerating, Air-Conditioning Engineers (ASHRAE)

d. American Society for Testing and Materials (ASTM)

e. Illuminating Engineering Society of North America (IESNA)

f. Indoor Air Quality Web site, EPA

g. Multizone Modeling web site, NIST Contains software tools for performing multizone analysis (e.g. CONTAMW), information on the applications of multizone modeling, multizone modeling case studies, and references to multizone modeling publications.

h. Occupational Safety and Health Administration (OSHA)

i. Sheet Metal and Air Conditioning Contractors Association publishes Indoor Air Quality Guidelines for Occupied Buildings Under Construction. The standard can be ordered at SMACNA, 4201 Lafayette Center Drive, Chantilly, VA 20011-209.

AG1.4 Relevant Codes & Standards

AG1.4.1 Minimize Energy Consumption:

AG1.4.1.1 Executive Order 13123, "Greening the Federal Government Through Efficient Energy Management"

AG1.4.1.2 WBDG -

a. Minimize Energy Consumption and Energy Codes & Standards

b. Energy Analysis Tools

AG1.4.1.3 Energy Star©, EPA

AG1.4.1.4 Federal Energy Management Program (FEMP), DOE

AG1.4.1.5 High Performance Commercial Buildings: A Technology Roadmap by U.S. Department of Energy.

AG1.4.2 Optimize O&M Practices

AG1.4.2.1 (NASA NPG 8831.2D, Facilities Maintenance Management

AG1.4.2.2 NASA RCM Guideline

AG1.4.2.3 NASA Reliability Centered Building and Equipment Acceptance Guide

AG1.4.3 Optimize Site Potential

AG1.4.3.1 Executive Order 13148, Greening the Government Through Leadership in Environmental Management

AG1.4.3.2 Executive Order 13006, Locating Federal Facilities on Historic Properties in Our Nations Central Cities

AG1.4.3.3 Executive Order 12072, Federal Space Management

AG1.4.4 Protect & Conserve Water. Executive Order 13123, Greening the Federal Government Through Efficient Energy Management

AG1.4.5 Use Green Products

AG1.4.5.1 Executive Order 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition

AG1.4.5.2 ASTM 2129 - Standard Practice for Data Collection for Sustainability Assessment of Building Products

AG1.4.5.3 ISO 14040 Series - Life-Cycle Assessment Standards

AG1.4.5.4 WBDG -

a. Building Integrated PV (BIPV)

b. Electric Lighting Controls

c. Energy Efficient Lighting

d. Fuel Cell Technology

e. Green Products

f. High Performance HVAC

g. Life-Cycle costing

h. Solar Water Heating

i. Sun Control & Shading Devices

j. Windows & Glazing

k. Choose Green Report

AG1.4.5.5 Energy Star©, EPA

AG1.4.5.6 Environmental Building News

AG1.4.5.7 Environmental Design & Construction Magazine

AG1.4.5.8 Green Building Network materials sourcebook, City of Austin Green Builder Program

AG1.4.5.9 Green Building Resource Guide by John Hermannsson. Taunton Press, 1997

AG1.4.5.10 GreenSpec™ - The Environmental Building News Product Directory

AG1.4.5.11 GSA Federal Supply Service Environmental Products and Services Guide

AG1.4.5.12 Guide to Resource Efficient Building Elements by Tracy Mumma. National Center for Appropriate Technology's Center for Resourceful Building Technology, Missoula, MT. Online version

AG1.4.5.13 oikos© Green Building Source - Green Product Information

AG1.4.5.14 PATHNET.org - Excellent repository of building materials, case studies, and innovative techniques

AG1.4.6 Evaluate Environmental Preferability Using LCA:

AG1.4.6.1 WBDG - Life-Cycle costing

AG1.4.6.2 Athena

AG1.4.6.3 BEES

AG1.4.6.4 The Environmental Resource Guide by American Institute of Architects (AIA), Joseph A. Demkin (Editor). New York: John Wiley & Sons, Inc., 1996

AG1.4.7 Maximize the Recycled Content of All New Materials

AG1.4.7.1 WBDG - Green Products

AG1.4.7.2 Comprehensive Procurement Guidelines (CPG), EPA

AG1.4.7.3 Environmentally Preferable Purchasing Program (EPP), EPA

ATTACHMENT G2. Example Solicitation for Commissioning Authority

(CA) Selection

The following is an example solicitation for obtaining firms interested in being considered for serving as the NASA Commissioning Authority for projects at the specified location:

NASA will receive submittals of qualifications for firms to serve as the Commissioning Authority for building commissioning services.

Definition: Building commissioning is a quality process emphasizing procedures to ensure that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the owners project requirements. The process begins during project planning and extends through design, construction, activation, and operations and maintenance. Building commissioning concepts can be applied throughout the life of the facility. The following are fundamental principles of building commissioning:

a. Identifying and documenting the functional requirements (user defined), facility requirements (as developed by the project team), and the basis and intent of the design;

b. Establishing processes to verify that project requirements are achieved; using a commissioning plan; using a commissioning authority; and including commissioning requirements in construction contracts; and

c. Using functional performance testing and predictive technologies to ensure proper facility operation and to identify and eliminate latent defects prior to accepting new facilities or equipment (incorporating all the elements of NASA's RCBEA program).

Commissioning, during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted standards and they receive adequate operational checkout by installing contractors.

a. Verify and document proper performance of equipment and systems,

b. Verify that O&M documentation left onsite is complete,

c. Verify that the owner's operating personnel are adequately trained, and

d. Verify compliance with NASA Design and Construction Standards.

NASA will contract directly with selected firm(s). Commissioning services may include the following:

a. Commissioning plan development;

b. Commissioning budget development;

c. Review of Design Intent, Basis of Design, design drawings and specifications, control interface diagrams and one-line diagrams at several design phase milestones;

d. Preparation of detailed commissioning specifications;

e. Reviewing contractor submittals of updated commissioning plan and schedule, shop drawings and product submittals;

f. Leading and documenting commissioning meetings;

g. Preparing functional performance test procedures;

h. Assembling O&M materials into a systems manual; and

i. Witness contractor execution of startup, flushing and cleaning, and functional performance tests.

Projects to be commissioned include extensive complex systems with building construction costs exceeding $10 million. Potential projects include the _____ Addition (__,000 gsf), the _____ Building (__,000 gsf), and the _____ Expansion/Renovation (__,000 gsf). These facilities variously include offices, classrooms, auditoria, teaching and research laboratories, state-of-the-art VAV air conditioning systems, laboratory utilities, chillers, cooling towers _____ and _____will start construction during 2000. _____ will bid in summer 2001. Each construction period will be about ___ months.

Plans are available for review in the _____ Office at (NASA Facility). Review prior to qualifications submittal is not

required.

Preferred qualifications include a minimum of three years of hands-on commissioning experience with elements of general construction such as roofs, wall assemblies, automatic doors, controlled-environment chambers, VAV supply and exhaust ventilation systems with off-set tracking control for laboratories, fume exhaust systems, chillers, cooling towers, laboratory utility services, DDC environmental control systems, fire alarm systems, electrical primary and secondary distribution, substations, switchgear, breaker coordination, motor controls, variable frequency drives, energy conservation measures.

Interested and qualified firms are invited to submit a statement of qualifications consisting of the following:

a. History of the company;

b. Commissioning expertise and capability;

c. Local experience over the last 3 years on projects of similar size and scope;

d. Reference contacts with telephone numbers;

e. Resumes of key management personnel and their positions;

f. Qualifications of personnel to be assigned to NASA projects, their certifications and commissioning responsibilities;

g. Personnel rate schedule;

h. Location of the firm and proximity to the work site; and

i. Professional liability insurance.

Submittals shall include three (3) copies each of a letter of interest, the above listed information, and completed SF 254 Form.

NASA is an affirmative action/equal opportunity employer and encourages minority and women owned firms to participate.

NASA may interview some firms responding to this solicitation. Firms invited for interview will be required to present comprehensive evidence of commissioning documents developed for a similar project commissioned by the firm. Final selection, in each case, will be based upon the qualifications listed above, in comparison to the needs of the project, and the quality of the documents provided during the interview. Review documents will be returned to the applicant at the end of the interview. Firms selected for final consideration will be notified on or about _____, 2001.

Send submittals to: (NASA Address)

Submittals must be received no later than 5 p.m. on _____, 2004.

ATTACHMENT G3. Example Functional Performance Testing Documents and RCBEA testing Specifications

AG3.1 Example Functional Performance Test Documents. In this section examples of commissioning documentation related to Functional Performance Tests (FPT) are provided to clarify the level of detail required in the execution and documentation of commissioning procedures. The following is a list of the three documents involved, all relate to the same functional performance test.

a. FPT specification: the specifications are included in the bid documents. The example in paragraph AG3.1.1, illustrates the level of detail necessary to convey to bidders the scope of their work for a specific test. On a typical project, there may be between 20 and 100 similar FPT specifications for mechanical components and systems.

b. FPT Procedures: the procedures are the detailed instructions of how to execute a specified FPT. An example FPT procedure is provided in paragraph AG3.1.2.

c. FPT Data Forms: the data forms provide a written record of the performance observed during the execution of the FPT procedure. An example FPT data form is provided in paragraph AG3.1.3.

AG3.1.1 Example: FPT Specification

Functional Performance Test Specification

(17550.3.3.F)

FPT: Air Handling Unit - Supply Air Control

1. System/Equipment to be Tested: AHU-1 and associated controls.

2. Functions to be tested: Damper and control valve operation to maintain

a. Air temperature at setpoint and

b. Minimum outside air.

3. Conditions of the Test: System shall be in occupied mode.

a. Test operation with outside air temperature below 45°F, at approximately 60°F, and above 82°F.

b. Test system at 100-percent, 65-percent and 25-percent, airflow.

Repeat conditions i) and ii) with carbon dioxide concentrations above 800 PPM in the return air stream.

4. Acceptable Results:

a. Discharge air temperature shall be within +/-1°F of setpoint for all outside air conditions.

b. Outside air volume shall be within -0 percent and +5 percent of scheduled minimum under minimum outside air conditions. Under all other conditions, outside air volume shall vary according to the economizer sequence of control.

c. Outside air volume shall modulate to maintain carbon dioxide levels below 800 PPM.

AG3.1.2 Example: FPT Procedure

Functional Performance Test Procedure

FPT #17550-6
AHU-1 Supply Air Control

Objective:

To demonstrate proper operation of the AHU-1 supply air control, as required by specification 17550.3.3.F.

Prerequisites:

Successful completion of component FPT's, including calibration for all control points associated with operation of this air handler. Successful completion of preceding FPT procedures specified in this Section. Successful completion of heating water and chilled water systems FPT's as specified elsewhere. Successful completion of balancing.

Participants:

Commissioning Coordinator, one EMCS control contractor technician, one HVAC contractor technician, Owner's Witness.

Tools & Equipment:

DDC-08 (Portable control system interface): by EMCS subcontractor.

Procedure:

Set up a trend log with sampling at 30 second intervals for the following points:

1. Outside air temperature input

2. Supply air temperature input

3. Return air temperature input

4. Mixed air temperature input

5. Minimum outside air volume input

6. Main outside air volume input

7. Carbon dioxide sensor input

8. Minimum outside air damper output

9. Main outside air damper output

10. Return air damper output

11. Heating valve output

12. Cooling valve output

A. Outside air temperature below 45°F, 100-percent system volume:

1. Observe and record the outside air temperature.

2. If outside air temperature is above 45°F, override the sensor input with a 42°F value. Record value.

3. If outside air temperature is above or near the supply air temperature setpoint, reset the supply air temperature setpoint upward to create a demand for heating. Record value.

4. With system in occupied mode, command all terminal units to 100-percent open. Observe and record position of minimum outside, main outside, exhaust, and return air dampers. Record outside air volume.

5. Observe and record positions of heating and cooling valves.

6. Observe and record supply air temperature.

B. Outside air temperature below 45°F, 65-percent system volume:

1. With system in occupied mode, command sufficient terminal units to minimum position to reduce system volume to 65-percent of maximum. Observe and record position of minimum outside, main outside, exhaust, and return air dampers. Record outside air volume.

2. Observe and record positions of heating and cooling valves.

3. Observe and record supply air temperature.

C. Outside air temperature below 45°F, 25-percent system volume:

1. With system in occupied mode, command sufficient terminal units to minimum position to reduce system volume to 25-percent of maximum. Observe and record position of minimum outside, main outside, exhaust, and return air dampers. Record outside air volume.

2. Observe and record positions of heating and cooling valves.

3. Observe and record supply air temperature.

D. Outside air temperature between 45°F and 82°F, 100-percent volume:

1. Observe and record the outside air temperature.

2. If outside air temperature is below 45°F, or above 82°F, override the sensor input to a value 5°F below return air temperature. Record value.

3. If outside air temperature is below or near the supply air temperature setpoint, reset the supply air temperature setpoint downward to create a limited demand for cooling. Record value.

4. With system in occupied mode, command all terminal units to 100-percent open. Observe and record position of minimum outside, main outside, exhaust, and return air dampers. Record outside air volume.

5. Observe and record positions of heating and cooling valves.

6. Observe and record supply air temperature.

E. Outside air temperature between 45°F and 82°F, 65-percent of maximum volume:

1. With system in occupied mode, command sufficient terminal units to minimum position to reduce system volume to 65-percent of maximum. Observe and record position of minimum outside, main outside, exhaust, and return air dampers. Record outside air volume.

2. Observe and record positions of heating and cooling valves.

3. Observe and record supply air temperature.

F. Outside air temperature between 45°F and 82°F, 25-percent of maximum volume:

1. With system in occupied mode, command sufficient terminal units to minimum position to reduce system volume to 25-percent of maximum. Observe and record position of minimum outside, main outside, exhaust, and return air dampers. Record outside air volume.

2. Observe and record positions of heating and cooling valves.

3. Observe and record supply air temperature.

G. Outside air temperature above 82°F, 100-percent volume:

1. Observe and record the outside air temperature.

2. If outside air temperature is below 82°F, override the sensor input with an 85°F value. Record value.

3. If outside air temperature is below or near the supply air temperature setpoint, reset the supply air temperature setpoint downward to create a limited demand for cooling. Record value.

4. With system in occupied mode, command all terminal units to 100-percent open. Observe and record position of minimum outside, main outside, exhaust, and return air dampers. Record outside air volume.

5. Observe and record positions of heating and cooling valves.

6. Observe and record supply air temperature.

H. Outside air temperature above 82°F, 65-percent of maximum volume:

1. With system in occupied mode, command sufficient terminal units to minimum position to reduce system volume to 65-percent of maximum. Observe and record position of minimum outside, main outside, exhaust, and return air dampers. Record outside air volume.

2. Observe and record positions of heating and cooling valves.

3. Observe and record supply air temperature.

I. Outside air temperature above 82°F, 25-percent of maximum volume:

1. With system in occupied mode, command sufficient terminal units to minimum position to reduce system volume to 25-percent of maximum. Observe and record position of minimum outside, main outside, exhaust, and return air dampers. Record outside air volume.

2. Observe and record positions of heating and cooling valves.

3. Observe and record supply air temperature.

J. Restore outside air temperature sensor input to normal operation.

K. Restore air terminal units to normal operation.

L. Restore supply air temperature setpoint to design.

M. Record date and time of completion of procedure.

N. Retrieve trend log data.

O. Revise trend log sampling rate to 15 minutes.

P. Retrieve trend log data after 7 days.

AG3.1.3 Example: FPT Data Form

FPT #17550-6
AHU-1 Supply Air Control

First test or retest? _____

Trend log file name _____

Date/time initiated _____

Sampling rate (sec., min., hr.) _____

A. Outside air temperature below 45°F, 100-percent volume:
- 1. Outside air temperature
- 2. Outside air temperature input override value _____
- 3. Supply air temperature setpoint reset value _____
- 4. Damper positions
  - a. Minimum outside air (100-percent open) _____
  - b. Main outside air (0 percent open) _____
  - c. Exhaust air (0 percent open) _____
  - d. Return air (100-percent open) _____
  - e. Outside air flow volume (2100 - 2205 CFM) _____
- 5. Valve positions
  - a. Heating valve (modulating open) _____
  - b. Cooling valve (0 percent open) _____
- 6. Supply air temperature (setpoint +/- 1°F) _____

B. Outside air temperature below 45°F, 65-percent volume:
- 1. Damper positions _____
  - a. Minimum outside air (100-percent open) _____
  - b. Main outside air (0 percent open) _____
  - c. Exhaust air (0 percent open) _____
  - d. Return air (100-percent open) _____
  - e. Outside air flow volume (2100 - 2205 CFM) _____
- 2. Valve positions
  - a. Heating valve (modulating open) _____
  - b. Cooling valve (0 percent open) _____
- 3. Supply air temperature (setpoint +/- 1°F) _____

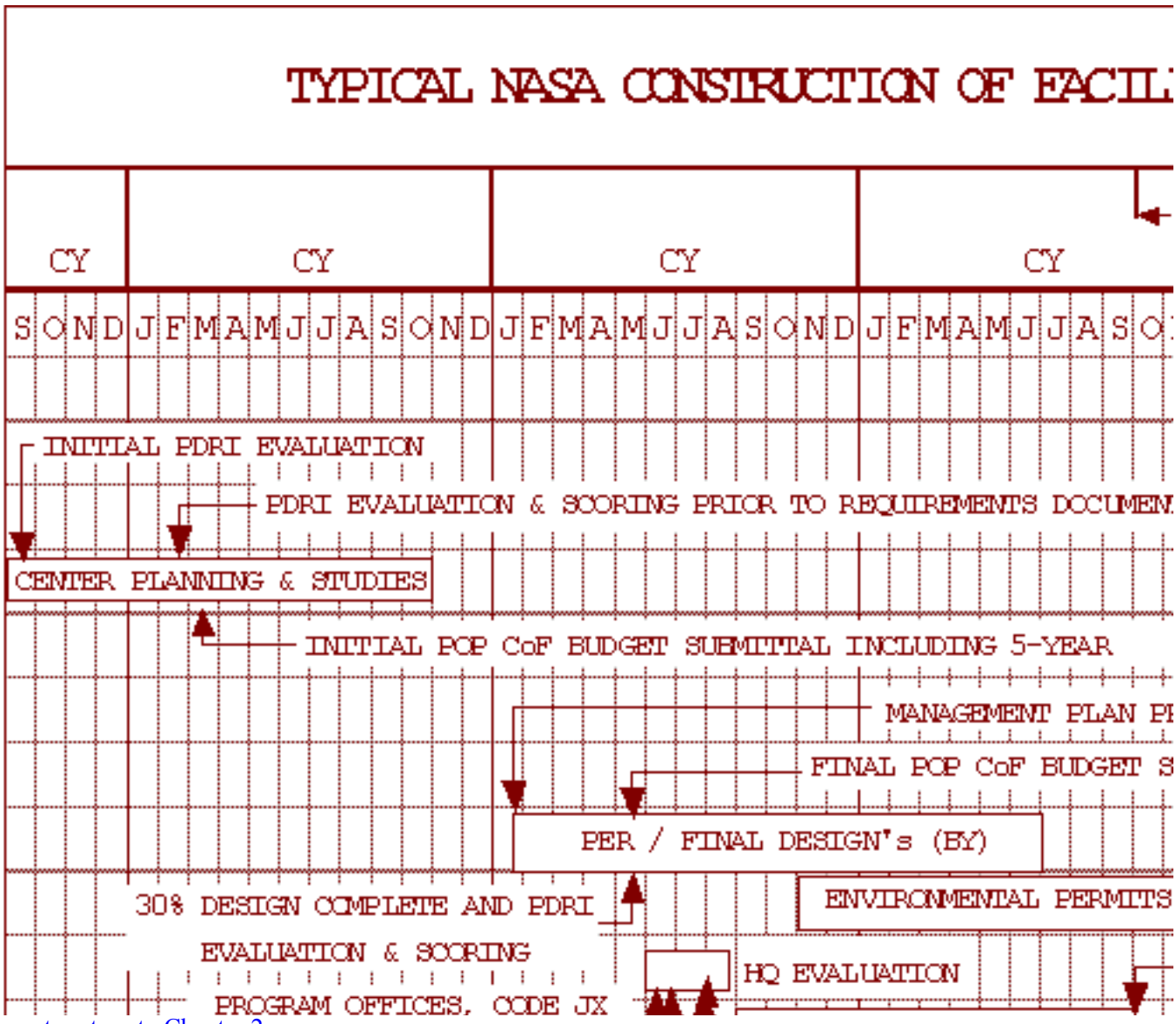
C. Outside air temperature below 45°F, 25-percent volume:
- 1. Damper positions

AG3.2 RCBEA testing Specifications. These specification are included in the NASA reliability Centered Building and Equipment Acceptance Guide available on the NASA Headquarters Code JX web site.

APPENDIX H: Facility Project Implementation Guide (FPIG) Requirements (Must Do)

The following list includes the "is/are required" and "must" requirements in the FPIG. These are statements imposing a necessity to act. Users should review the guide for "shall" statements, which are obligations to act; "should" statements, which implies obligation or preference, but not absolute necessity; and "will" statements, which are predictions of future action. The "is/are required" and "must" statements are presented here for quick reference. Users should review the referenced paragraph to ensure that the statement is not taken out of context.

Paragraph Reference	Subject	Description
2.2.3	Fragmentation	In establishing the scope of a facility project care must be exercised to include all of the needs generated by the same set of circumstances in a single project to avoid fragmentation or even the appearance of fragmentation (see Appendix A, Definitions, for "fragmentation" and "facility project" definitions). Work cannot be fragmented (separated) solely to avoid approval requirements.
2.2.4	Incremental Programming for Facility Requirements	Each increment must be planned to provide a usable facility on a schedule that meets the need date established by the functional requirements.
2.2.4.1		In these cases, the project scope should be determined by the amount of work that is scheduled to be in place during the program year. A limitation of funds clause (see NASA FAR Supplement (NFS)), 48 CFR Chapter 18 Part 1852, Subpart 1852.232-77 Limitation of Funds -Fixed- Price Contract) must be included in contracts that are incrementally funded in this manner.
2.2.4.2		For proposed CoF projects, which are an increment of a larger total requirement, the individual project justification must highlight this relationship and include the following: (see paragraph 2.2.4.2 for list.)



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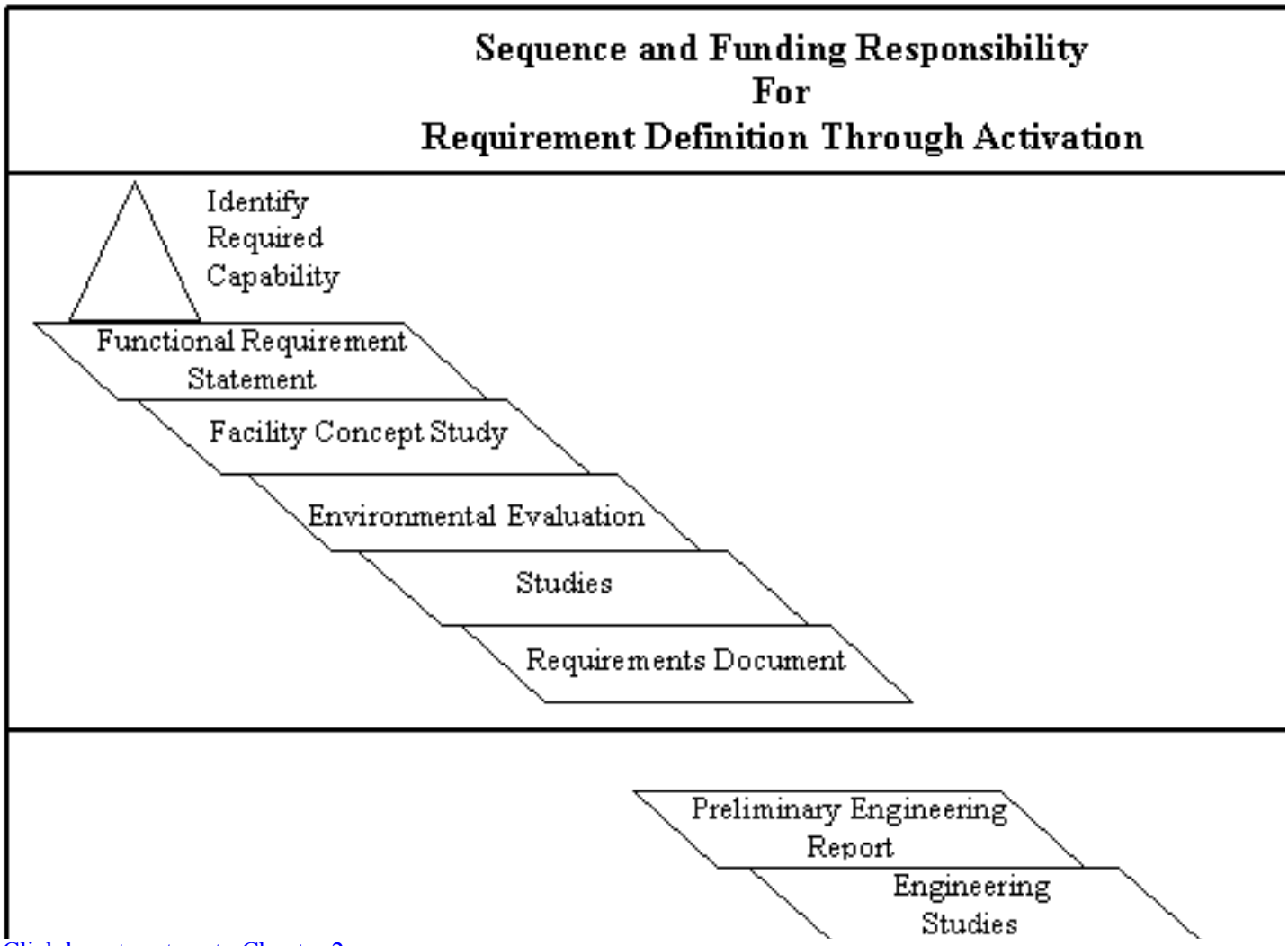

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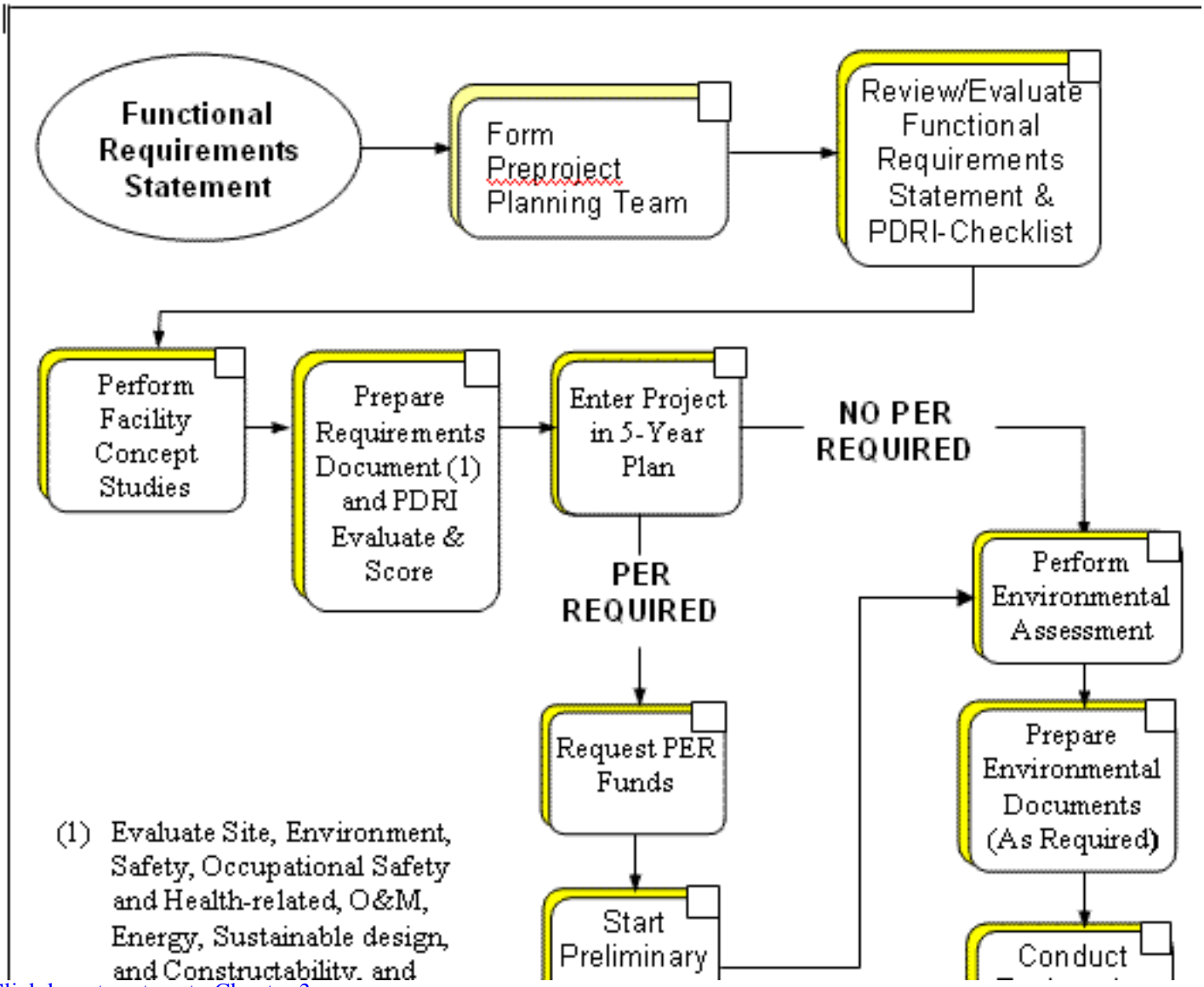

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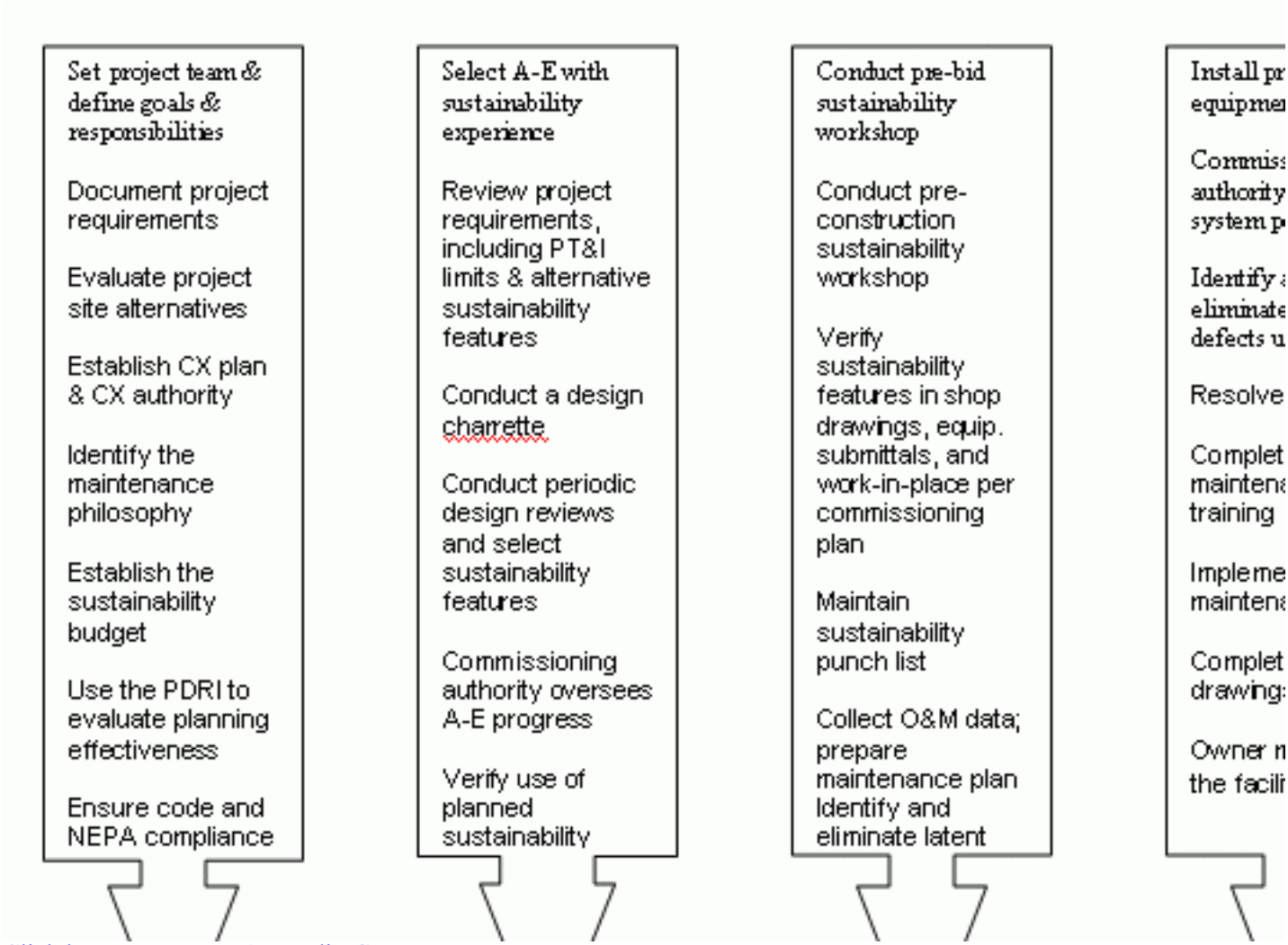

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